HEATING AND VENTILATING

The Air Conditioning Monthly

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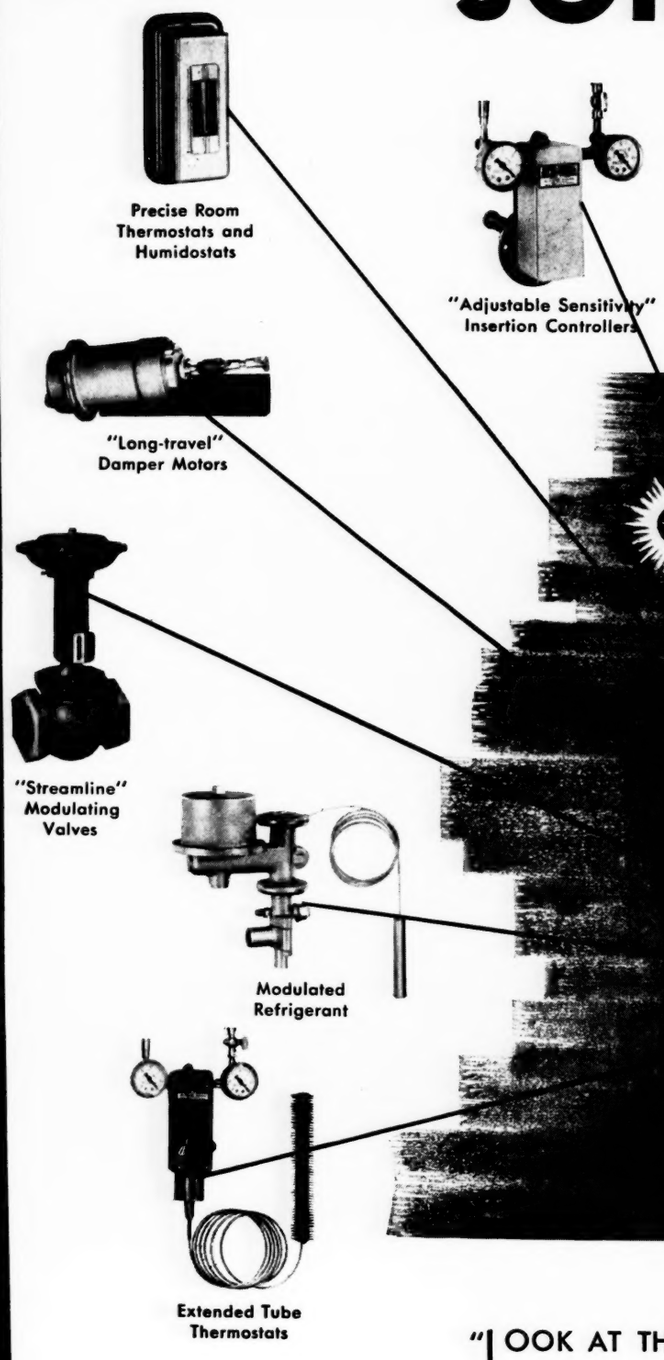

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HEATING AND VENTILATING

The Air Conditioning Monthly

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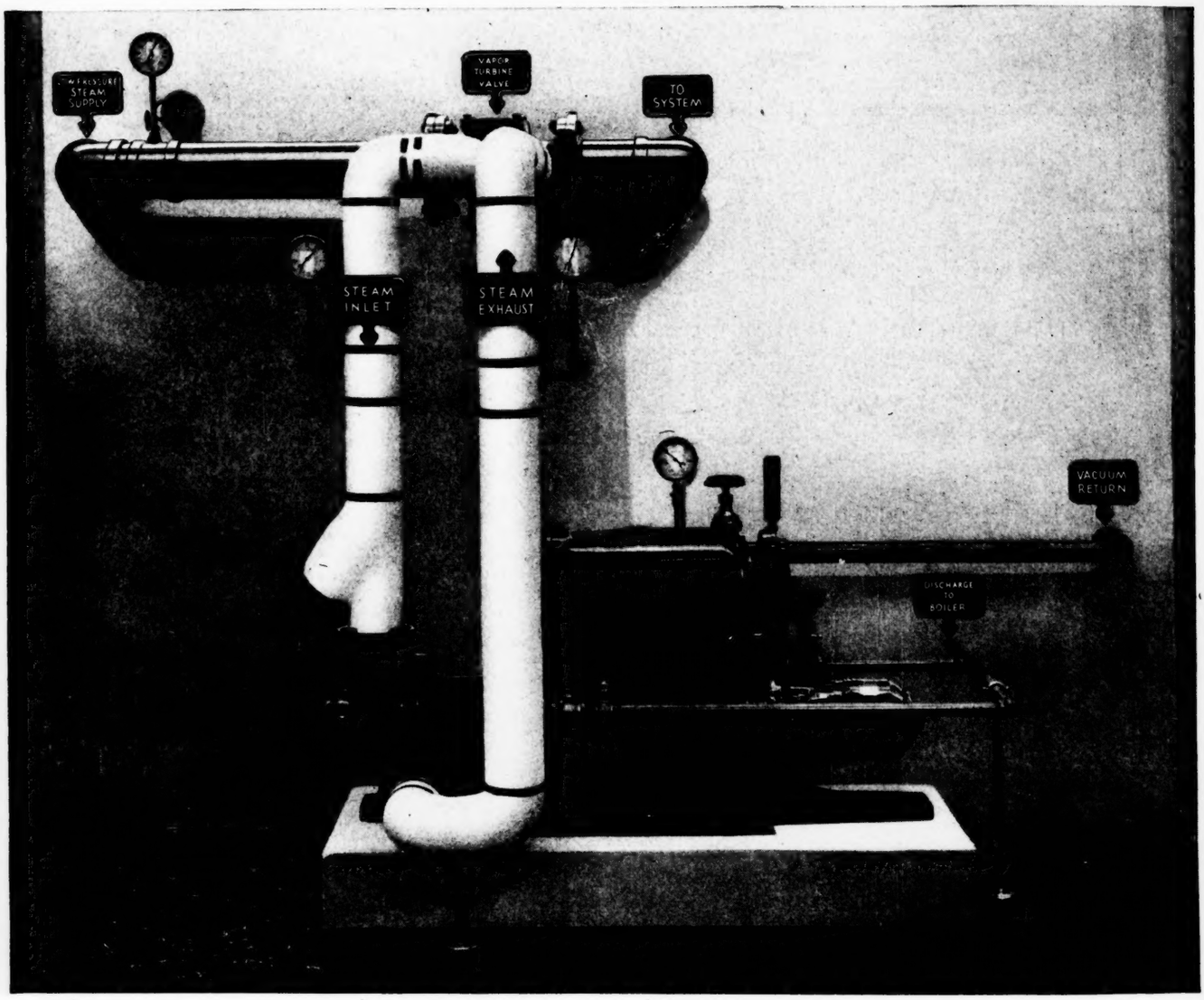
Interrupted Electric Service will not Stop this Nash Heating Pump



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is independent of electric current failure, and continues to operate as long as there is steam in the system.

This is because the prime motive power of this economical pump is a special steam turbine, controlled by a unique "Vapor Turbine Valve", which automatically bypasses from the heating main a small portion of steam, the exact amount necessary to develop the power needed to remove the condensate and maintain the required vacuum on the system. Even this small amount is passed immediately back to the mains, and goes on to the system with little heat loss. This pump operates on any system, high or low pressure.

The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

THE NASH ENGINEERING COMPANY

205-A S. WILSON ROAD, SOUTH NORWALK, CONNECTICUT, U. S. A.

INDUSTRIAL AIR CONDITIONING —An Essential to Production

WINNING the War is the major activity of the U. S. in 1942. To speed production is the immediate objective of all of us behind the fighting lines—specifically of all of us engaged in one way or another in Air Conditioning.

Air Conditioning functions, separately or combined, are now more than ever before essential in speeding production. Consider just a few applications.

Dehumidifying of blast furnace air increases steel furnace or foundry capacity at least 10%—and metals are the very foundation of modern war. Drying of air is essential in making concentrated foods—and we are committed to a policy of feeding other democracies, implying long periods of storage, which has resulted in a revival of the dehydrated food industry.

Cooling equipment is busily at work in producing low temperature atmospheres corresponding to great altitudes for the testing of aircraft engines. Some of these same airplane plants are windowless for blackouts—and cooling is required because of process, body, and sun heat. Wherever precision metal working is carried on—gage, die, and toolrooms—cooling and heating and air cleaning all find applications.

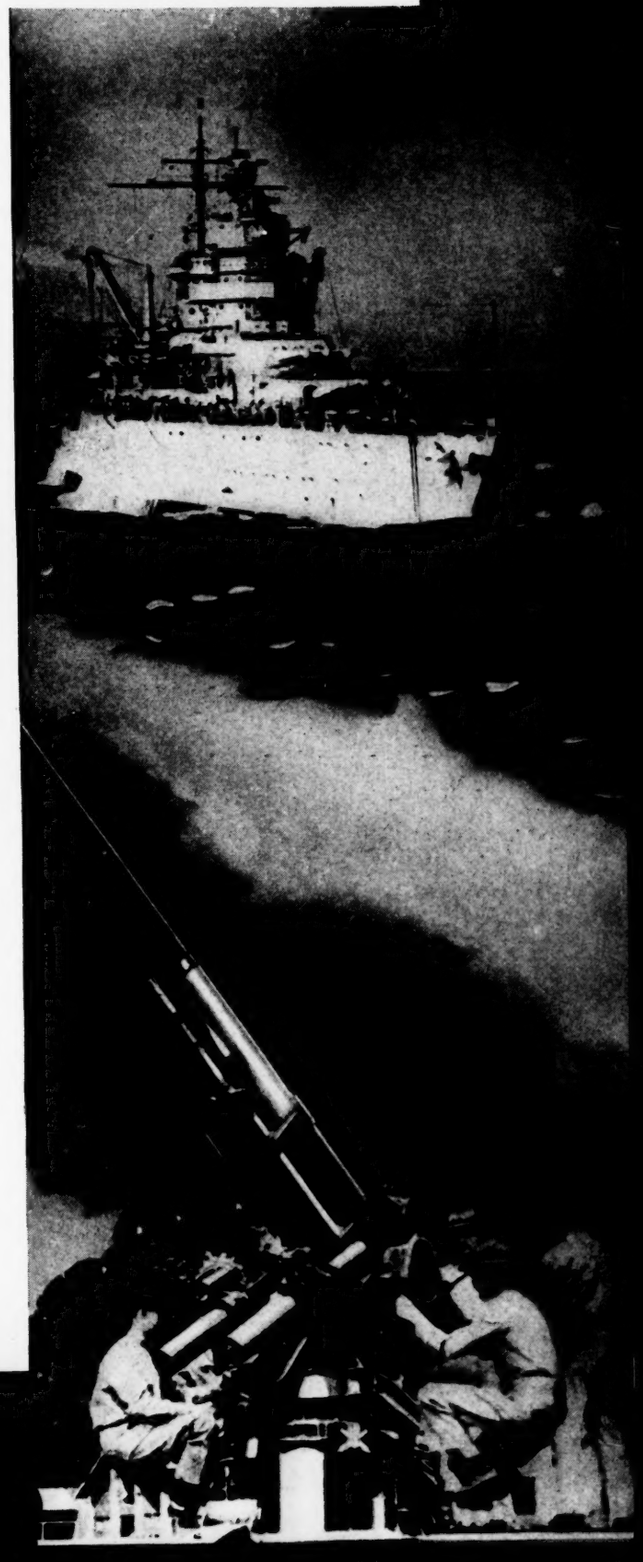
Heating of industrial buildings is obviously universal in this country, with all types of fuels having advantageous application.

Air cleaning has become more and more a necessary function; dust is harmful to precisely finished metal surfaces; it builds upon and may eventually ruin electrical insulation; it is almost fatally harmful in many chemical processes and so on.

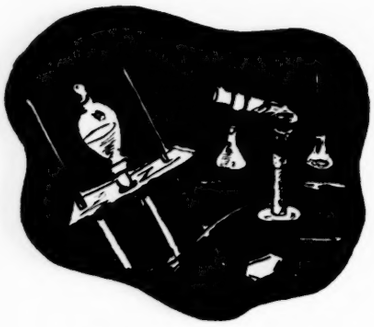
Humidifying, next to heating, the first conditioning function in textile plants, is a necessity for year-round operation not only in cotton and rayon mills but even where glass fabrics are manufactured.

Among the newer applications of industrial **ventilation** is that in magnesium foundries; here sulphur is being used to control combustion and the resulting sulphur dioxide is harmful to workers. Similarly, carbon tetrachloride fumes from resin core washes used in foundries casting thin parts requiring smooth finishes make ventilation a necessity, since phosgene may be formed.

The foregoing exemplifies Air Conditioning's part in winning the War, but does not detail the picture. The articles which follow expand the view and prove the **essential**-ness of a range of outstanding installations in a wide variety of necessary industries.



Engineer Mirror Plant



operated by United States Army at Mariemont, Ohio, is completely air conditioned to insure maximum production in spite of future blackouts and outside weather conditions.

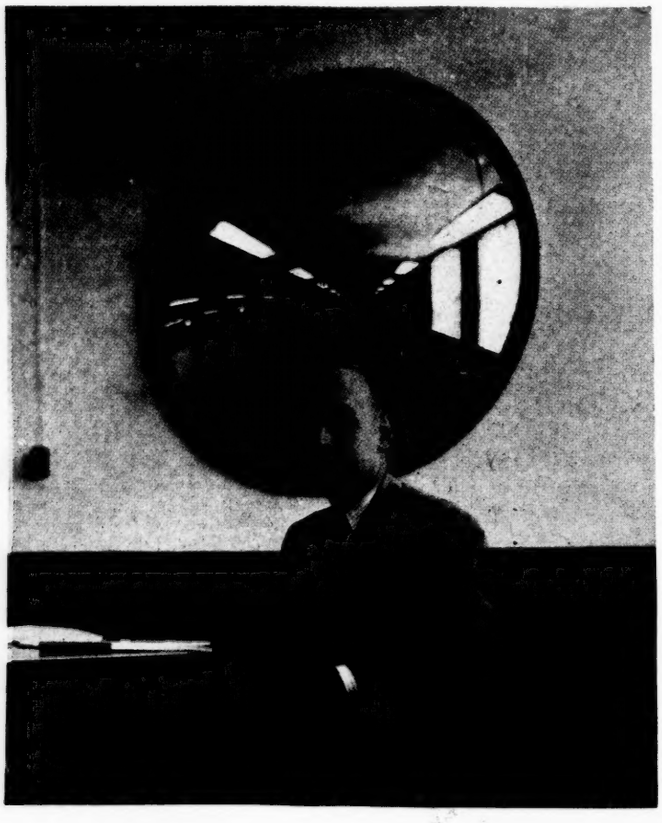
By JOSEPH F. KERN, JR.†

THE standard anti-aircraft searchlight of the U. S. Army is the 60 in. model. These lights have a tremendous candlepower output, the secret of which lies in the metal reflectors which are used for forming the light beam. These metal reflectors are made by a secret process and have many advantages over glass reflectors. They can not be shattered by bullets; they will withstand much rougher treatment than glass reflectors and they can be reproduced in much less time and with fewer skilled workers than glass mirrors require.

Soon after the beginning of the defense program a bottleneck began to develop in the production of these huge reflectors. Since there was no regular demand for reflectors of anywhere near this size private production facilities were restricted. As a result the Army decided to construct and operate a plant which could turn out the reflectors in sufficient quantities to break the bottleneck.

†Associate Editor, HEATING AND VENTILATING.

Capt. Frank H. Forney, officer in charge of the Army's Searchlight Mirror Plant. On the wall can be seen one of the 60-in. molds used for constructing the metal searchlight reflectors.



Construction

The Engineer Mirror plant, located on the Little Miami River at Mariemont, near Cincinnati, Ohio, is the result of their decision. Because of the emergency, the utmost speed was necessary in the construction of the building. The excavation was started four days after the land was purchased even though there was available only an estimate of the building's cost, the general floor plan, and the architect's rendering. Construction drawings and plans were made while the building was under way and as the drawings were completed they were taken into the field sometimes without waiting for reproduction. The entire plant was designed and built in 157 days. The design and construction supervision were done by the Cincinnati, Ohio, U. S. Engineer District for the Engineer Board of the Corps of Engineers, U. S. Army the operating agency.

The building is a one-story structure, approximately 260 ft wide by 120 ft deep with a 17½ ft ceiling. It has a 200 by 80 ft basement with a 6½ ft ceiling and a penthouse on the roof which encloses the air conditioning and ventilating equipment. In the rear of the building is a steam plant which generates steam for heating only. A short distance in front of the plant is a small building which is occupied by the caretaker.

The entire main building, except for the office space, is of the windowless type. For blackout purposes and for sealing up the plant in case it is necessary to close the plant for any length of time, the windows in the office and the heating plant have been equipped with shutters of steel plates 3/16 of an inch thick.

Plant Layout

The first floor of the plant is occupied by the large plating tank room surrounded on two sides by small rooms where the other work of the plant is carried on.

The tank room houses the electroplating tanks which rest on piers in the basement and project a short distance above the first floor. Heat exchangers and filters for some tanks are lodged in the basement.

Since the building is of the windowless type it is entirely air conditioned. The cooling for the air conditioned system is supplied by cold water from a well which was dug on the property. Two air conditioning units are used, one for the offices and one for the factory.

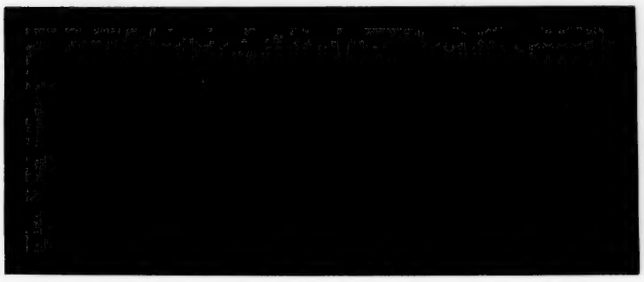
The plant is lighted by fluorescent lights which help reduce the air conditioning load. The major part of this load is due to the heat released by the plating tanks. It is estimated that each of these tanks produces about 3 kw of heat — a considerable portion in the form of latent heat, due to the evaporation of moisture from the open surface.

It has been estimated that the daily maximum load on the factory system is approximately 210 tons while on the office system it is 14 tons. The water is supplied at a temperature of 55F and is discharged at about 67F. Part of the water from the cooling system is discharged onto the roof. It is estimated that this helps reduce the load by about 20 tons.

It should be pointed out, that this plating process differs from many other plating processes in that there are no dangerous fumes discharged from the surface of the tank. This considerably simplifies the problem of air conditioning the plant and also it makes it possible to recirculate a large portion of the air.

Air is brought into the penthouse, where the plant air conditioning system is located, through a louvered opening in the south wall of the plant. The outside air first passes through a bank of air operated dampers which are tied in with another bank of air operated dampers. The amount of air to be recirculated can be selected and adjusted by regulating the damper settings. After the air is mixed it passes through a bank of American Copper Maze air filters and then through Aerofin cooling coils through which cool well water is passed. Next, the air is passed through steam heated Aerofin coils equipped with Webster Sylphon traps.

The water for cooling is supplied by a deep well pump from a well located close to the boiler plant. While water is actually supplied at 55F the system



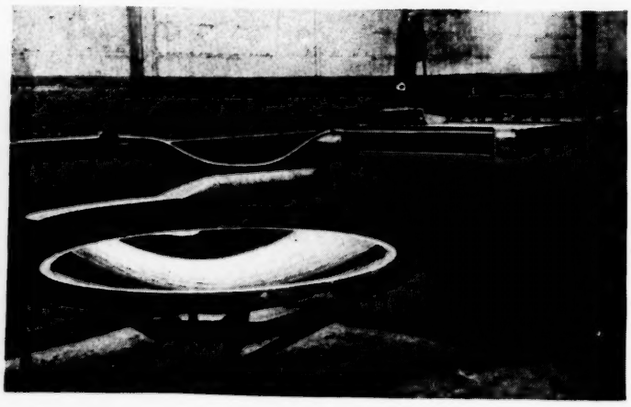
was designed so that it can maintain the desired conditions with well water as high as 57F.

After the conditioned air leaves the heating coils it is picked up by a 70,000 cfm Sturtevant fan driven by a 40 hp Allis Chalmers motor. On leaving the fan the air is divided into two streams, one going to the tank room and the other to various small rooms at the side of the tank room.

The air for the tank room leaves the penthouse through a duct which runs across the top of the roof. Two main supply ducts, taken off the main duct, run at the ceiling the length of the tank room and discharge the conditioned air horizontally toward the center of the room.

Most of the air recirculated from this room is withdrawn through a large opening in the ceiling, although some of the air passes down the stairways into the basement and some passes into the small rooms at the side of the tank room.

The principal reason for conditioning the tank room is to remove approximately 250 kw of heat which is given off by the various plating tanks. A considerable portion of the heat from the tanks is released in the form of vapor from the exposed surface of the tank,



although appreciable amounts of sensible heat are given off by the exposed walls in the basement below the main tank room.

These walls release a small amount of heat to the basement air which makes it necessary to ventilate this area. This is accomplished by a double 15,000 cfm blower which draws the air from the basement and forces it through a duct either to the paint room above or to a discharge outlet on the roof.

The second air circuit supplies air to the small rooms at the side of the tank room. These rooms house the machine shop, receiving room, buffing machines, paint spray booths, carpentry shop, and shipping room.

The air for these rooms is supplied by the main system in the penthouse but after leaving the fan this air passes through a booster heating coil. This coil was installed to make it possible to maintain correct conditions in the small side rooms which do not have the same type of load as the main tank room.

Approximately 20,000 cfm of air is needed for the paint spray room. Part of this air is supplied by the fans in the basement, part by leakage into the room from the tank room and part by the secondary air conditioning system. As mentioned previously the air from the basement is carried through a duct which opens to an exhaust on the roof or to the paint spray room. When the paint spray booths are operating a separate exhaust fan in the room is started. This drops the air pressure so that air from the basement passes into the room instead of to the outside, also some air from the secondary air conditioning system and from the main tank room enters the room to help ventilate.

In the small room where the mirrors are buffed there are approximately 20 hp of electric motors plus a large number of lights giving off heat to the room. Because of this large heat load it has been found necessary to place two 4 sq ft openings in the tank room wall to allow sufficient air from the tank room to enter so that reasonable temperatures can be maintained.

As mentioned previously the office space is air conditioned by a separate system. While this system is of the conventional type the return ducts are unusual in that they are of clay pipes and are buried beneath the floor. It was necessary to use this type of return duct since there is no basement under the offices.

Heating Plant

The boiler house located at the rear of the main building is equipped with three Pacific steel boilers fired by Freeman underfeed stokers. This plant supplies all the steam for process use and for heating. During the winter the air for the boilers is drawn from the pipe tunnel which connects the heating plant with the main building. This serves to help ventilate the basement of the main building and at the same time saves fuel.

(Top) Closeup of the piping system which supplies steam to the Aerofin coils. Webster Sylphon traps are used. (Upper center) Section of the roof of the extension to plant showing the roofing being applied over corkboard insulation. (Lower center) Closeup of the Freeman stokers which supply coal to the Pacific low pressure steam boilers. (Bottom) Exhaust system used for removing the dust released during buffing operations. Discharged air from the fan is filtered before it returns to the room.

Libbey-Owens-Ford Glass Co.

maintains steady volume of production on safety glass independent of weather by maintaining 5% relative humidity at 145F in plastic drying room equipped with humidifier.

By LESTER T. AVERY†

IT'S really plate glass plus! As you drive along the streamlined highway in your streamlined car, at 50 or 60 or even 80 streamlined miles per hour, do you think what that windshield really is, and how greater *safety* was built into it? The side windows, too, for that matter, are equally safe and while you don't plan on it, it's really comforting to know that the glass around is less likely to shatter in case of accident.

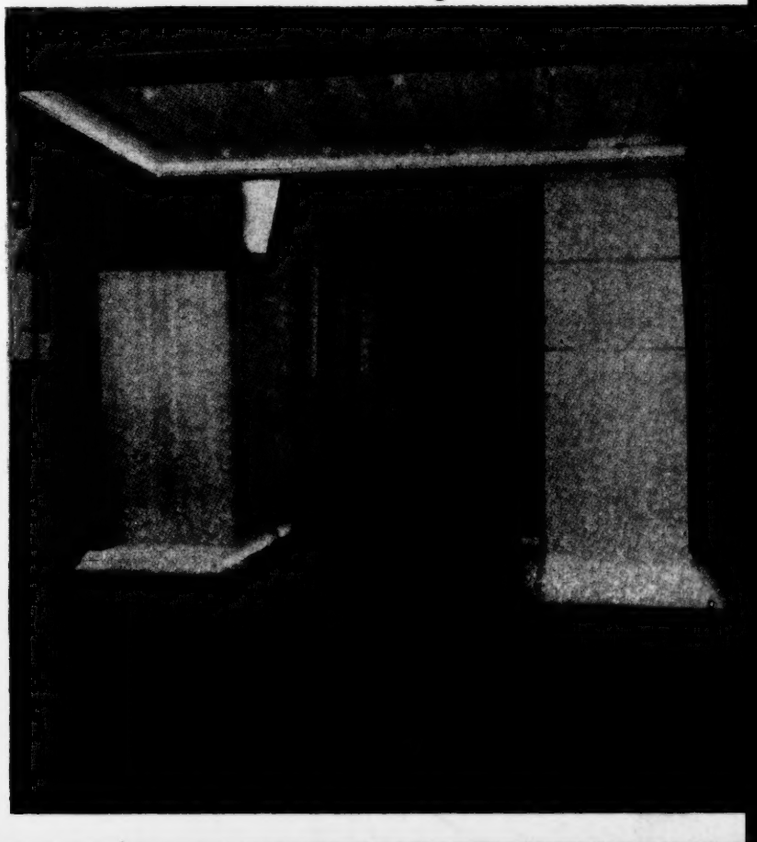
But it is no accident that so-called safety glass has been developed to its present high stage of perfection and low cost of purchase. That has come, as have so many other developments in present day transportation equipment, as a result of hard work, careful engineering and selected methods. Safety glass is a combination of two layers of plate glass with a layer of plastic material between. Libbey-Owens-Ford Glass Company use a special material which they call Polyvinal Acetal Resin. Safety glass is just as good as the bond obtained between the plastic and the glass. Present day safety glass is better than earlier efforts chiefly because of improving the bonding qualities of the plastic by air conditioning.

A drying room is used in which the plastic is dried before being applied between the two layers of the plate glass. This drying room handles about 125,000 sq ft of plastic per day. If the residual moisture content of the plastic is too high upon removal from this drying room, it will not adhere to the glass well enough to pass the stability tests to which it must be subjected. If the humidity in the oven is too high, it is impossible to lower the residual moisture content of the plastic. If the temperature of the oven is too low, the plastic must be seasoned in the oven for too long a time to be practical.

It is therefore necessary to control the conditions of dryness and temperature in the drying room or drying oven, as it is sometimes called, and this permits the volume of production to be maintained, irrespective of outside weather conditions.

Whenever you speak of moisture removal—just plain drying—you generally think of heat. Obviously hot air will hold more water vapor than cold air, so if dry air is wanted, the first thing to do is to heat it.

Heat alone may or may not suffice, depending on a number of things. How high an air temperature can the product stand? How much water is to come out of the product and how fast? Is it relative humidity you need to control or absolute humidity? Libbey-Owens-Ford had to find the answer to these and other allied questions affecting the manufacture of safety glass in quantity production under all weather conditions. The result was the fixing of 145F and 5% relative humidity, 47.5 dewpoint, 48.5 gr per lb, as the desired condition in the drying room.



†The Avery Engineering Co., Cleveland, Ohio.

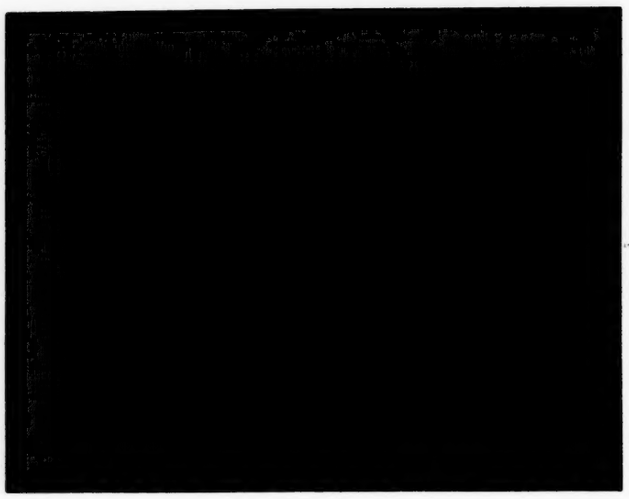


Fig. 3. Flow diagram showing conditions of the air to and from the dryer and conditioned space. Outside air entering at left occasionally has a maximum condition of 95F dry bulb and 80F wet bulb. The outside air entering at the bottom circuit is for re-activating the silica-gel.

The rolls of plastic sheets passing through this room had to be dried a total of 16 lb of water vapor per hour, and the sheets were fed into the room at outside temperature, anything from 60F to 100F, depending on the weather. Some air came in through infiltration. The design therefore, required air to be supplied to the drying room at 150F D.B., 40.1 gr per lb. The flow diagram is shown in Fig. 3. Fig. 5 shows on the psychrometric chart the evolution of the air as follows:

Fig. 4. Overall view of the drying room and dryer with rolls of plastic in the foreground. The drying equipment was fitted in an area 10 x 10 ft on top of the girders above the drying room.

Outside air—150 cfm—at the maximum summer wet condition was taken as 95F D.B., 80F W.B., 75F dewpoint, 131.1 gr per lb. This is high moisture content but there are a few days in Toledo when such dewpoint exists. The equipment must take care of maximum load—not average. The 150 cfm outside air was allowed to make up a positive pressure on the room at the roll openings and around doors and panels. This outside air was passed first through an American Air Filter Airmat, thence through the Trane 4-row precooling coil. This coil used cold water at 55F to precool the outside air to a condition of 70F D.B., 67F dewpoint, 99.2 gr per lb.

The water outlet was connected to the 6-row precooling coil on the recirculated air circuit, to cool 1180 cfm of return air from 140F to 90F. This air was at the room dewpoint of 48.5 gr per lb, so that the two streams of air converged ahead of the Bryant silica gel dehumidifier to arrive at a mixed condition of 1330 cfm at 87.75F D.B., 50.5F dewpoint, 54.2 gr per lb. (See Fig. 3.) The recirculated air is filtered through Airmat filters to prevent dirt and dust getting into the gel bed. This type filter was used as it will not dry out in the hot return air, but will clean efficiently at the high temperatures existing.

The air was pre-cooled ahead of the gel bed to increase the efficiency of moisture removal. At 87.75F D.B., the Bryant 14-R unit will remove 38 gr per lb; whereas at the recirculated air temperature of 140F it will remove much less. Pre-cooling the outside air also had the effect of reducing the excessively high dewpoint of 131 grains to the more normal 99 grains, thus making a simple and economical plan that would handle peak loads effectively.

The fan furnished with the dehumidifier is balanced in static against the reactivating air static to maintain the seal in the rotating gel bed. This meant an auxiliary make-up air fan—Buffalo HVA—was needed in this circuit to pick up the static of the filters and pre-cooling coils. The discharge from this fan connected directly to the wet air inlet of the silica-gel dehumidifier. Air left this machine at 121F D.B., 21.5F dewpoint, 16 gr per lb, and then mixed with 3820 cfm recirculated air at 140F D.B., 48.5 gr per lb, resultant mixture being 5150 cfm at 135.1F D.B., 42.5F dewpoint, 40.1 gr per lb. (See Fig. 3.) This air was passed through another bank of filters to keep lint, dust, etc., from the reheating coils, thence through the re-heating coils to be heated to the temperature needed to maintain a 145F room, ordinarily about 150F. This air was handled by what is called the main supply fan, discharging directly to the room. You will thus note three separate fans were needed to properly handle this air.

There is also an air circuit for reactivating the silica-gel. As the gel bed becomes saturated with moisture it revolves through the seal into the reactivating chamber. Some 480 cfm of outside air is preheated to 270F, through three Trane 2-row heating coils in series, thus 6-rows total depth. This hot air is passed through the gel bed as shown in Fig. 5, drying out the gel, ready for repeating its work. A little outside air at

normal temperature is blown through the gel bed after reactivating, to cool it before passing through the seal to the drying chamber. Silica-gel can be reactivated with hot air from a gas burner or from a steam coil, as preferred. (See Fig. 1 for diagram of the silica-gel machine.)

The humidity control in this case was the simplest! Turn it on and let it run! There was no danger of getting the air *too dry,* as all of the apparatus was designed for peak moisture load and a lower dehumidifying load would permit a slightly lower inside moisture content. Actually, the relative humidity runs 3% to 5%. The pre-cooling water was controlled automatically by an Alco stop valve, connected into the silica-gel fan circuit, so the water would flow through the coils when and if the gel machine was operating. The rate of water flow was set by thermometers under normal load conditions. The design calls for 1½ gpm through outside air coil, mixed with 3.6 gpm supply to a total of 5.1 gpm to the recirculated air coil. Water leaves this coil at 83F under full load conditions.

The installation was made in the rafter space above the drying room, and a shoe horn would have been helpful as an erecting tool. All of the equipment mentioned above and shown in Fig. 3 was fitted in an area 10 ft wide, 10 ft long, on top of steel girders. The sawtooth roof permitted height at one end of 10½ ft, tapering down to 4 ft at the other end. Careful use of the available space permitted everything to go in and what is more important, allowed access to all parts for maintenance. If the author were to preach a sermon on the subject of air conditioning, he would dwell at length on the old saw, "Cleanliness is Next to Godliness." The design must permit access to filters, coils, and other parts for simple good housekeeping—cleanliness.

There are other methods of drying air. In fact, one of them was tried on this room before the silica-gel installation described above. Air can be dried by cooling to the desired dewpoint, say all the 5150 cfm, chilled to 42.5F dewpoint, exactly the same as the mixed dewpoint condition mentioned above. This, of course, requires cooling capacity to reduce the recirculated air from 140F to 42.5F, which is about 44 tons. The actual latent load is approximately 2½ tons. If the 55F water were used for sensible heat cooling from 140F to 80F, the refrigeration machine could be reduced to 17.5 tons, but you would still require 40 gpm of the cold water. Rather obviously this is not the economical method, either from the point of view of first cost or operating cost. With the silica-gel method, a maximum of 3820 cfm of recirculated air is bypassed at 140F. The silica-gel machine actually converts the latent heat to sensible heat by adsorption, thus air leaving the gel bed is 121F. This method requires very little reheating.

Where the refrigerating method of drying is used, the chilled air at 42.5F (the desired dewpoint) must be reheated to 150F, using large quantities of steam. Where the job requires low relative and absolute humidities, and reasonably warm temperatures, the silica-gel machine will work out economically, as it did in this case.

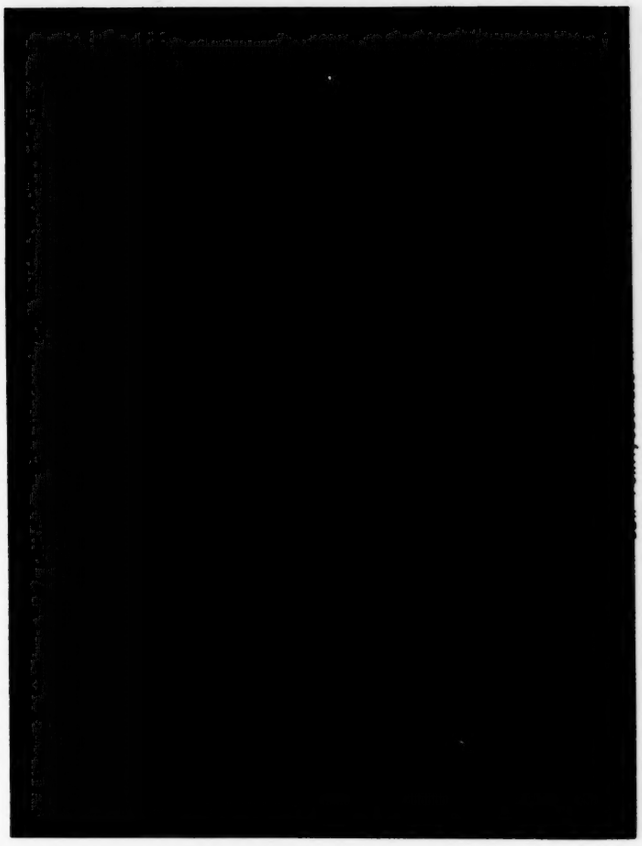


Fig. 5. The effect on the air as it appears when plotted on the psychrometric chart, and showing successively the outside condition, after passing coil, mixture with recirculated air, drying, increase of moisture in conditioned space.

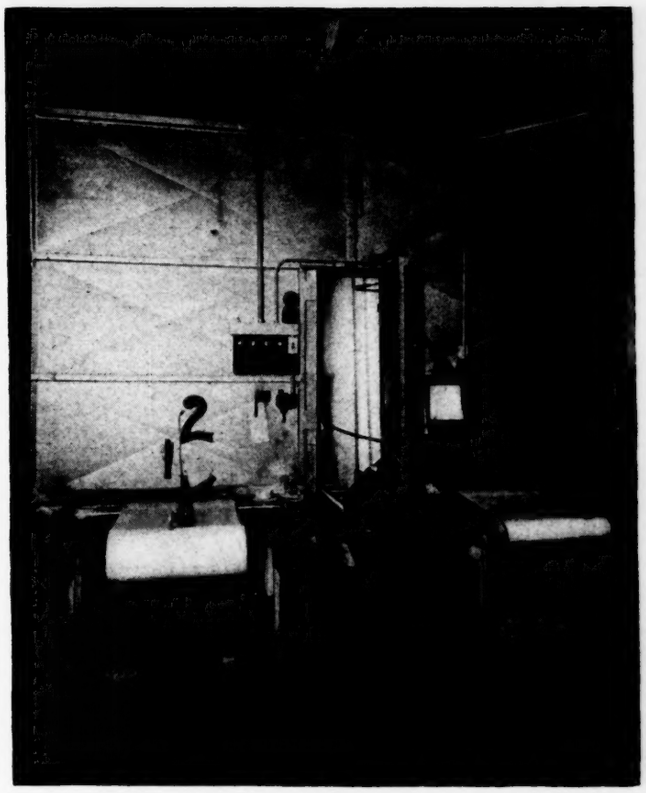
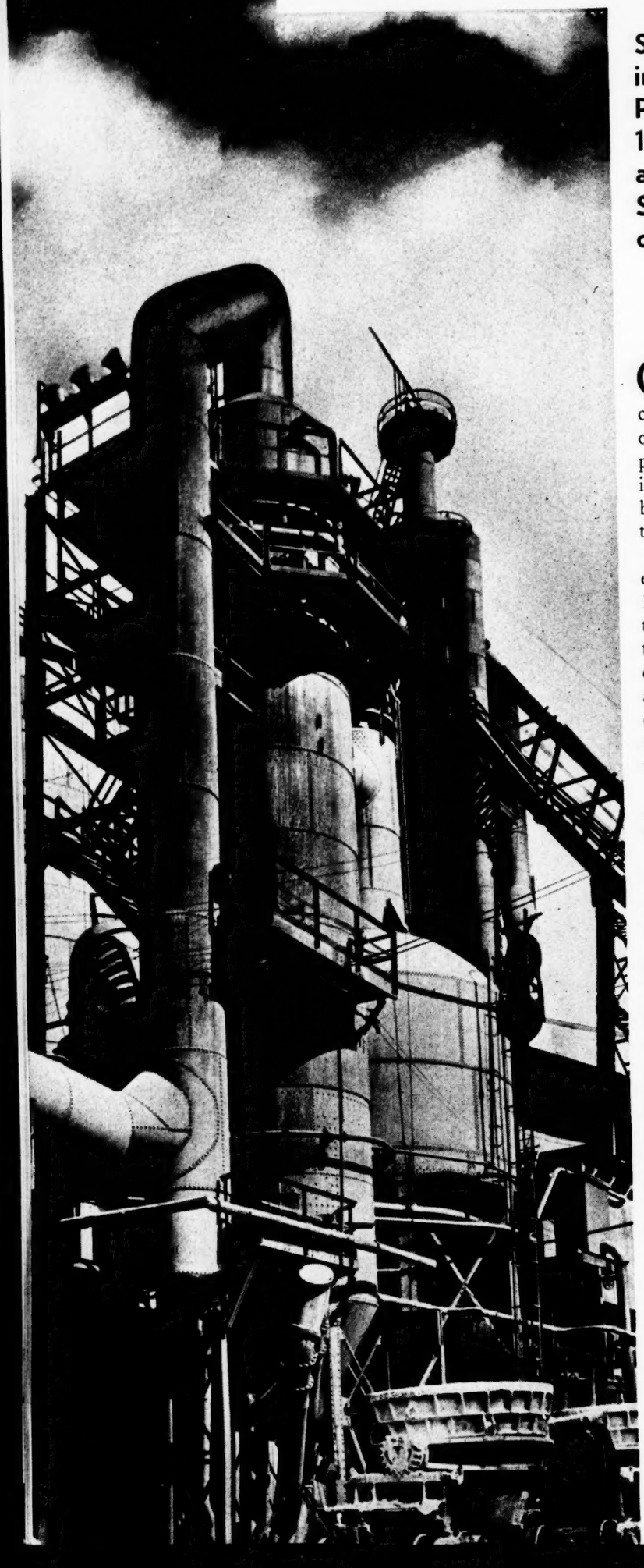


Fig. 6. Plastic in roll form being fed into the dryer. About 125,000 sq ft of the plastic handled per day.

Jones & Laughlin



Steel Corporation installs air conditioning at its No. 1 blast furnace at Aliquippa, Pa., obtains smoother operation with a 16% increase in pig iron production and a 4% reduction in coke consumption. Saving in electric energy more than offsets air conditioning operating cost.

By E. K. MILLER†

ON April 2, 1941, the Jones & Laughlin Steel Corporation put into operation the first modern air conditioning unit to be installed in the North for the conditioning of air blown into a blast furnace. The purpose of this installation was to obtain first hand information as to the benefits that could be expected by reducing and controlling the moisture content of the blast air.

As early as 1890 experiments were conducted on the effects of conditioning the air to blast furnaces and in 1904 an actual installation was made in a furnace of the Carnegie Illinois Steel Company at Etna, Pa. From that time other installations were made both in this country and abroad but by 1916 all of these had been abandoned due to the high investment and maintenance costs involved for it had been found that the equipment available was not suitable to effectively do the work.

In 1939 the idea of dry blast was revived and a successful installation was made in a blast furnace of Woodward Iron Company in Woodward, Alabama.

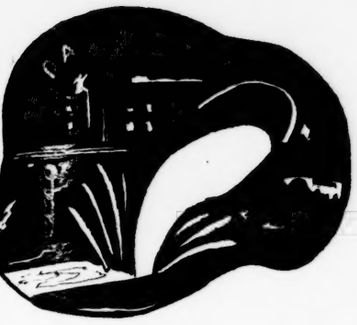
In order to determine first hand what results could be expected the Jones & Laughlin Steel Corporation decided in the latter part of 1940 to condition one of their furnaces.

Reasons for Conditioning Air

The reason for conditioning the air blown into the blast furnace is to maintain a constant low moisture content. In blast furnaces not conditioned it is necessary for the operators to try to outguess the weather 24 hours in advance of charging the furnace since the fluctuating moisture content of the atmosphere makes it necessary to change the proportions of raw materials charged into the furnace. These raw materials approximate 2000 ton of iron ore, 950 ton of coke, 500 ton of limestone and 4000 ton of air per day to produce 1000 ton of molten pig iron.

Ordinarily wide fluctuations in humidity cause an irregular blast furnace operation which results in decreased iron production. On hot humid days more coke must be charged per ton of iron to offset the excessive moisture in the air. Since there is 80,000 cfm blown into the furnace, the air carries with it into the furnace 7

†Assistant General Superintendent, Aliquippa Works, Jones & Laughlin Steel Corp., Pittsburgh, Pa.



tons of water per day for every grain of moisture content per cubic foot. This has the effect on extreme days of pouring 30 to 40 tons of water into the furnace.

Construction

The No. 1 blast furnace at the Jones & Laughlin Aliquippa Works is a huge steel shell 90 ft high and 28½ ft hearth diameter and is lined throughout with heat resisting brick nearly 4 ft thick. As the hearth temperature is about 3600F the hearth jacket and bosh are water cooled requiring about 9,000,000 gal of water per day.

Air Conditioning Equipment

The air conditioning equipment, which was furnished by the Carrier Corporation and installed by the Dravo Corporation of Pittsburgh, conditions the air by drawing it through two chilled water sprays, then passing it through eliminator plates where excess moisture is removed. The water is chilled to 38.5F by a Carrier 790 ton centrifugal refrigeration unit.

Results

In the first six months that the air conditioning equipment has been in operation on No. 1 blast furnace, from April to September, inclusive, it has definitely demonstrated that there is much to be gained by eliminating the high and widely fluctuating humidity in the blast air.

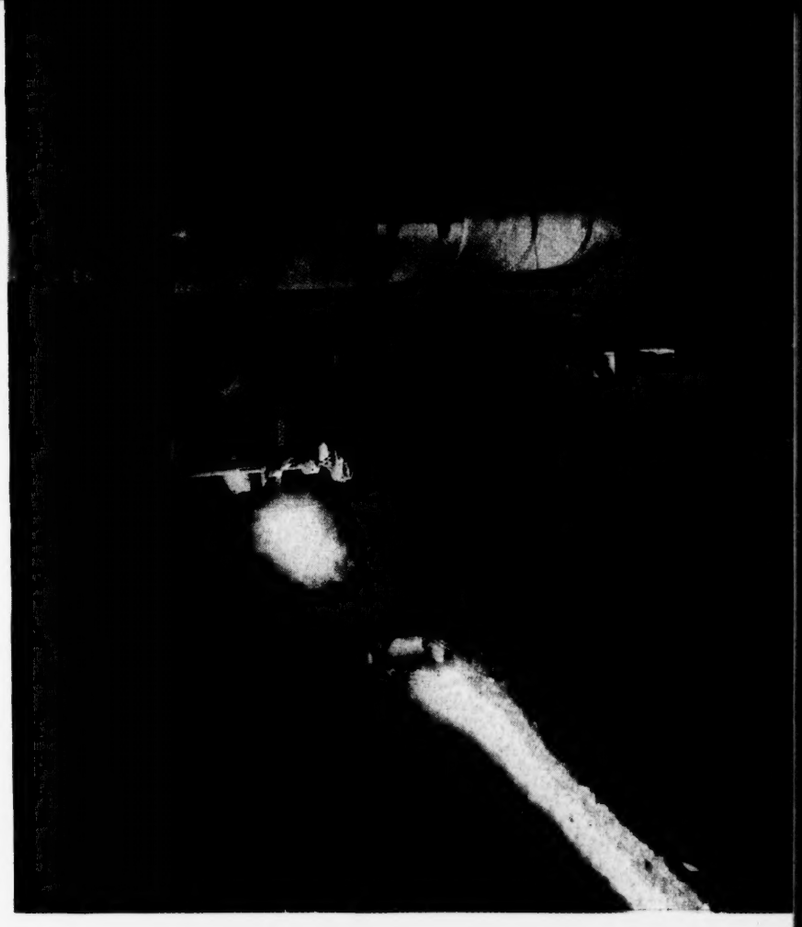
The operation of this furnace is noticeably smoother and more uniform than the other four blast furnaces which are not equipped with air conditioning and, of course, this is confirmed by an attractive improvement in iron production and coke consumption, as shown in table on page 51.

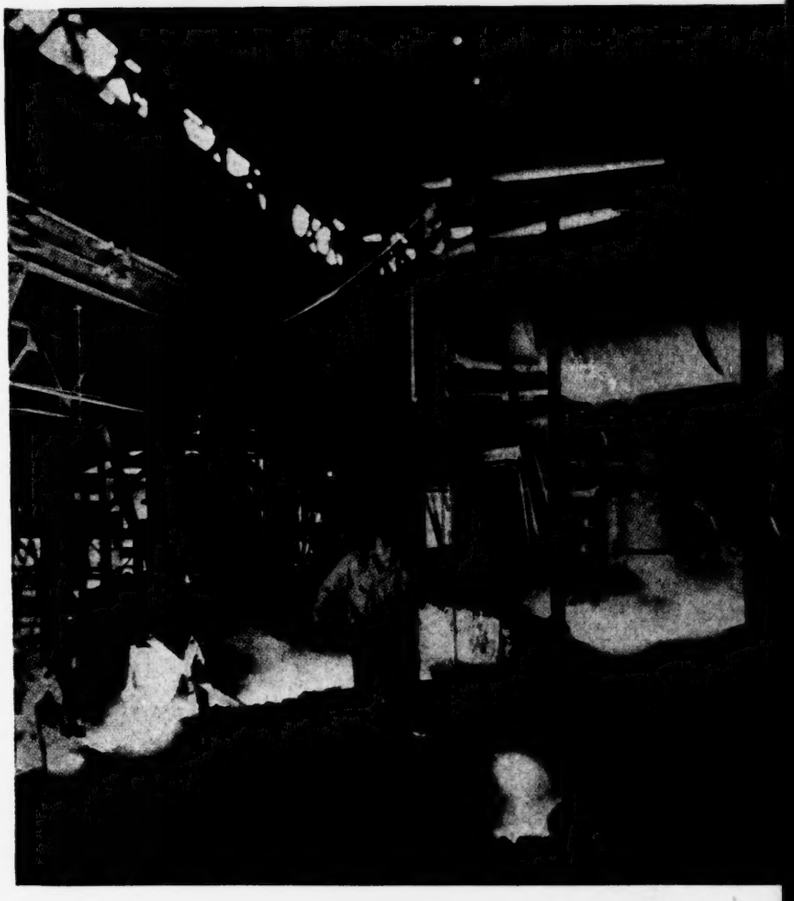
From the above tabulation which gives the humidity for 1941 showing the maximum, minimum and average for natural air, it can be seen that the conditioned air for the month of June was 3.351 grains; July, 3.642 grains; August, 3.499 grains; and September, 3.251 grains. In all cases the moisture content was over 3 grains due to the fact that when the pre-compression chilled water system was installed only one compressor was used on which the manufacturer guaranteed only 4 grains for June; 5 for July; 4 for August; 4 for September; and 4 for October. For the rest of the months of the year they guaranteed 3 grains.

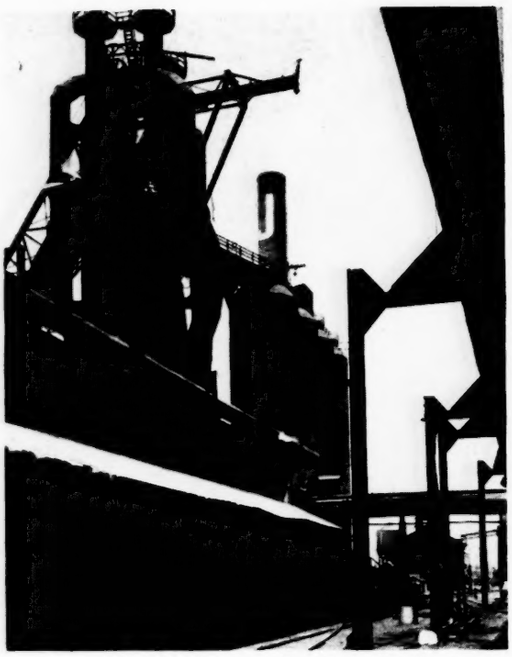
Our experience to date has shown that the furnace has operated more smoothly, drives more regularly, keeps a more constant wind blowing, more uniform heat, and a more uniform burden which, in turn, gives a more uniform temperature of iron and a more uniform analysis for our steel making units.

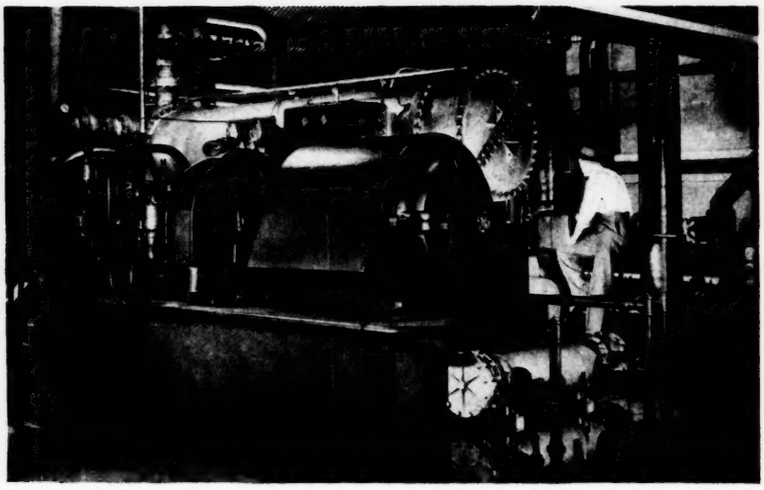
Conditioning No. 3 Furnace

Although there was no doubt in the minds of the operating men that air conditioning equipment had effected a substantial improvement in the performance of No. 1 blast furnace, it was decided, in order to ob-









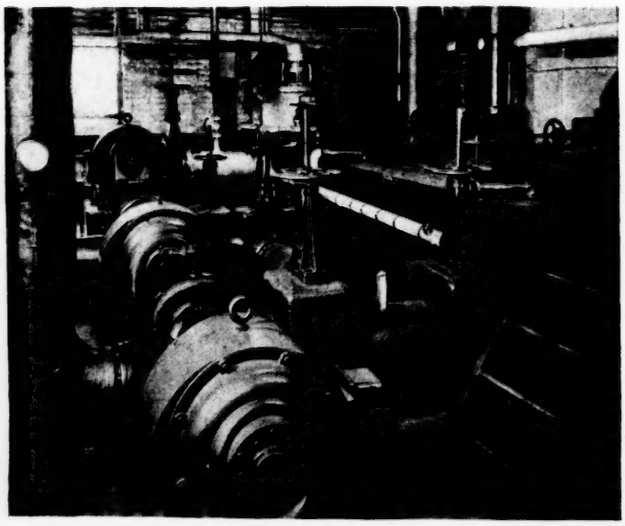
tain more conclusive data, to transfer the conditioned air to another furnace of the same size. Accordingly, the conditioned air was transferred from No. 1 to No. 3 blast furnace during the first half of September and again put back on No. 1 blast furnace during the second half of the month.

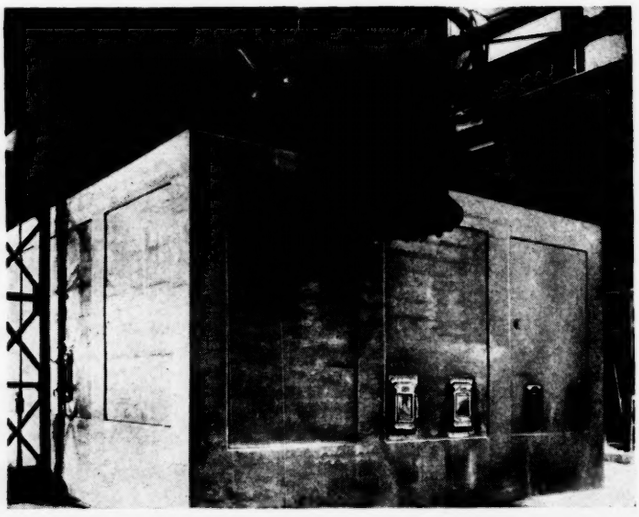
Immediately after switching conditioned air from No. 1 to No. 3 furnace, the production of No. 1 dropped off and the production of No. 3 increased correspondingly; that is, No. 1 decreased 141 net tons or 14.5% for the 13 day period, while No. 3 increased 134 net tons or 13.9%. For the second half of the month, the conditioned air was switched back to No. 1 furnace and it immediately recovered the production lost and the production of No. 3 blast furnace decreased correspondingly.

Savings

For the first six months of operation, the amount of steam saved on the turbo blower in blowing No. 1 blast furnace on air conditioning saved the equivalent of 2,900,000 kw hours. This, in turn, more than offset the operating cost of the air conditioning unit, after taking into account the loss of heat in the air entering the stoves which was at a lower temperature.

While the average increase in iron production was 16% during the summer months, June to September, inclusive, on the one furnace equipped with a precompression chilled water system at the Aliquippa Works, it is expected that when including winter months, the average increase in production throughout the year will be not less than 8%. A reduction in coke rate can also be claimed, which is approximately 4%.





HOW AIR CONDITIONING IMPROVES BLAST FURNACE OPERATION

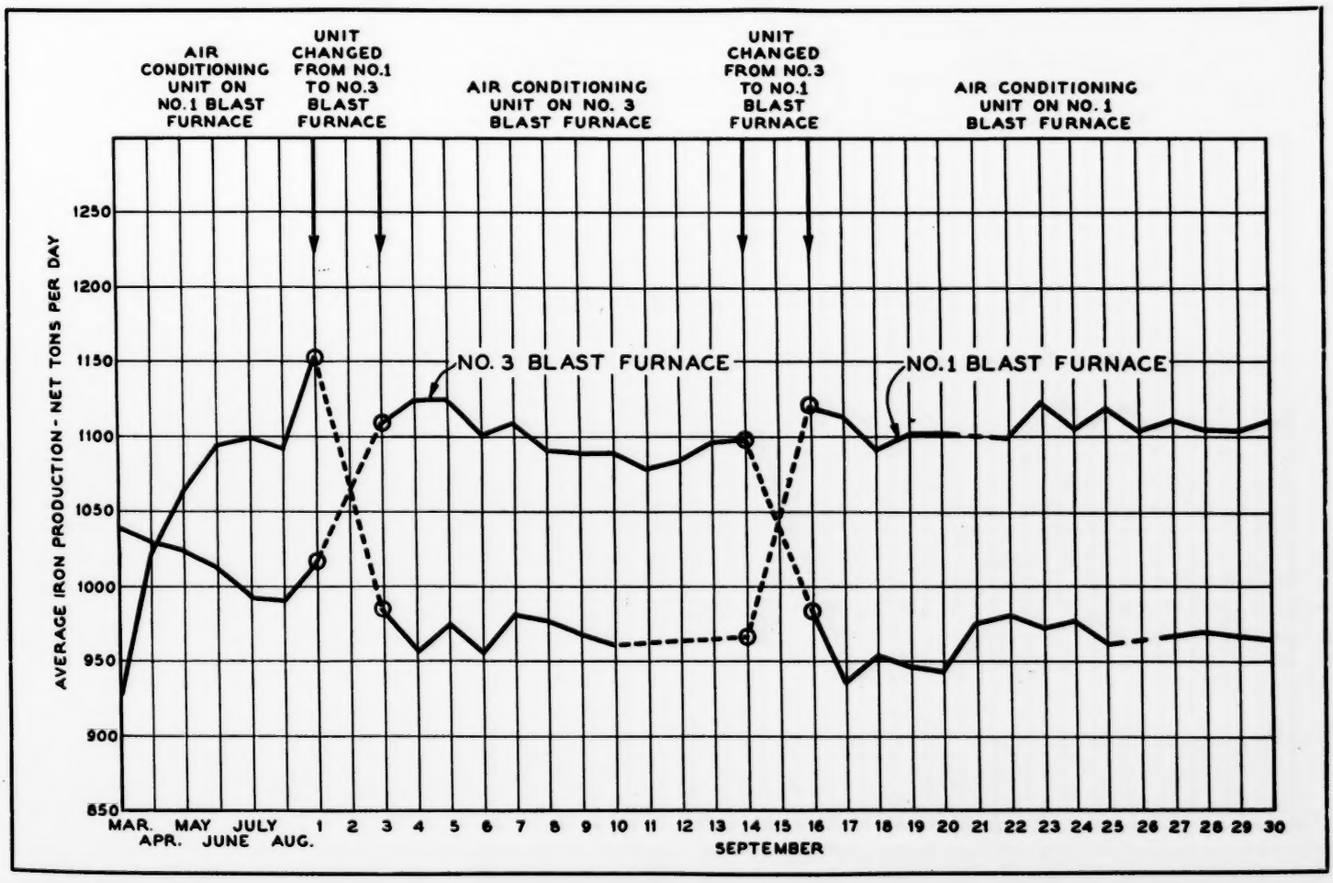
Period		Improvement With Air Conditioning Equipment		Humidity for Specific Months of 1941 Grains per Cubic Foot of Air			
				Natural Air			Conditioned Air
With Air Conditioning	Without Air Conditioning	Percent Increase in Iron Production	Percent Reduction in Coke Consumption	Minimum	Maximum	Average	
Apr. 1941 to Sept. 1941, Inc.	Monthly Average for Year 1940	8.22%	3.03%	1.355	9.962	5.087	3.298
June, 1941	June, 1940	14.55	4.31	2.746	9.066	5.666	3.351
July	July	16.67	5.46	3.064	9.962	6.702	3.642
August	August	14.84	3.04	3.064	8.782	5.757	3.499
September	September	18.46	.25*	2.849	9.635	5.398	3.251
June to Sept. Inc.	June to Sept. Inc.	16.07%	4.26%*				

*September, 1941, coke was not representative during the test period on air conditioning; consequently, the reduction of 4.26% indicated above was based on June to August, 1941, versus comparable months in 1940.

There are some people in the steel industry who do not think it is possible to make any savings on a 3 grain system and that it is necessary to go down to 1 grain of moisture to get any real results. From our experience to date, having six months' actual operation on one blast furnace, it would appear that a greater percentage of the maximum tonnage that can be expected will be produced from a 3 grain system.

However, at this time, I am not in a position to say that if you go lower than 3 grains you can not get more tonnage or lower coke consumption, but I believe, and this is only an opinion, as we have never actually operated a furnace under 2.95 grains, that if you go much under what we are operating, the furnace will have a tendency to hang and work on a higher pressure and will not produce as good a quality of iron on the lower grain system. However, that is just a matter of opinion, but next spring we should have a definite answer on this question as at present there are three 1-grain air conditioning systems being installed in other plants.

It would seem that air conditioning equipment offers the steel industry the most attractive means of increasing iron production in the interest of National Defense, and the equipment can be installed in a comparatively short time compared to building additional furnaces or beneficiating raw materials to increase production.


AIR CONDITIONING UNIT ON NO.1 BLAST FURNACE
UNIT CHANGED FROM NO.1 TO NO.3 BLAST FURNACE
AIR CONDITIONING UNIT ON NO. 3 BLAST FURNACE
UNIT CHANGED FROM NO.3 TO NO.1 BLAST FURNACE
AIR CONDITIONING UNIT ON NO. 1 BLAST FURNACE
NO. 3 BLAST FURNACE
NO.1 BLAST FURNACE
AVERAGE IRON PRODUCTION - NET TONS PER DAY
1250
1200
1150
1100
1050
1000
950
900
850
MAR. APR. MAY JUNE JULY AUG.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
SEPTEMBER

Colonial Tanning Company,

largest patent leather firm in U. S., eliminates a heavy loss, due to sticking of leather in summer, by air conditioning Boston warehouses in order to reduce humidity.

ONE of the most serious problems in the patent leather industry is that of moisture gathering on the face of the leather due to excess humidity in the air. This causes adhesion of the varnished sides which are usually stacked face to face to prevent scratching of the polished surface from the rougher inner side. After one week of ordinary summer temperatures and relative humidities the leather would be stuck together and ruined for sale at ordinary market prices. It then would have to be separated by placing it in a steam chamber and could be sold only at a heavy loss since after steaming the patent leather loses its luster. This loss might run from 40 to 50% of the market price of first class leather and since even a small truckload may be worth $2500 to $4000 this loss is quite serious.

Air Conditioning the Answer

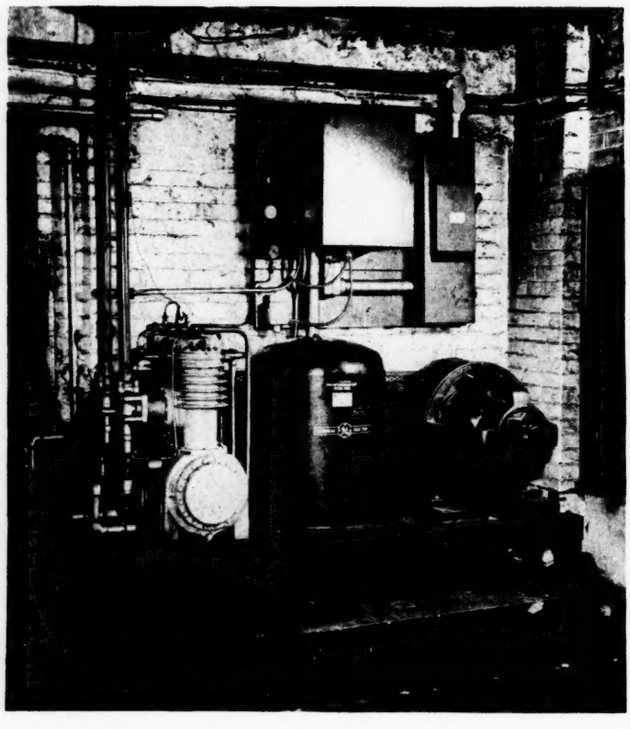
The Colonial Tanning Company, of Boston, the largest patent leather company in the United States, found that air conditioning is the answer to the problem of excess humidity.

Some six years ago the company had the Lawton Engineering Company install a complete air conditioning system in its salesrooms and offices, the primary purpose being to prevent this adhesion of the leather and resulting damage to the finish. The system employed a 20-ton General Electric compressor for cooling and dehumidifying while for heating and humidification in the winter it was tied in with the building's steam system. This system, like two others added later, was designed to reduce summer relative humidity to 40 to 50%, with temperatures averaging 68 to 70F.

Savings were so great after installation of air conditioning in the warehouse that the system quickly paid for itself and when the plant was enlarged about two years ago additional equipment was installed to take care of the increased area and greater quantity of leather thus handled. The second unit installed was a 10-ton Frigidaire self-contained air conditioner which was put in by the General Heat and Appliance Company of Boston. This unit recirculates only.

Recently, when more warehouse space was added, a third independent system was installed to care for the increased business. This consisted of two Carrier 5-ton self-contained units, caring for two separate rooms, one unit on each side of the partition and operating independently. They take part outside air from an alley, about 30 ft from the ground and were installed by the Boston Filter Company. All the installations maintain the same average temperature and relative humidity.

The first cooling system installed by Colonial Tanning Company consisted of this remote type 20-ton G-E compressor condensing unit in the basement serving conditioning units on the second and third floors.

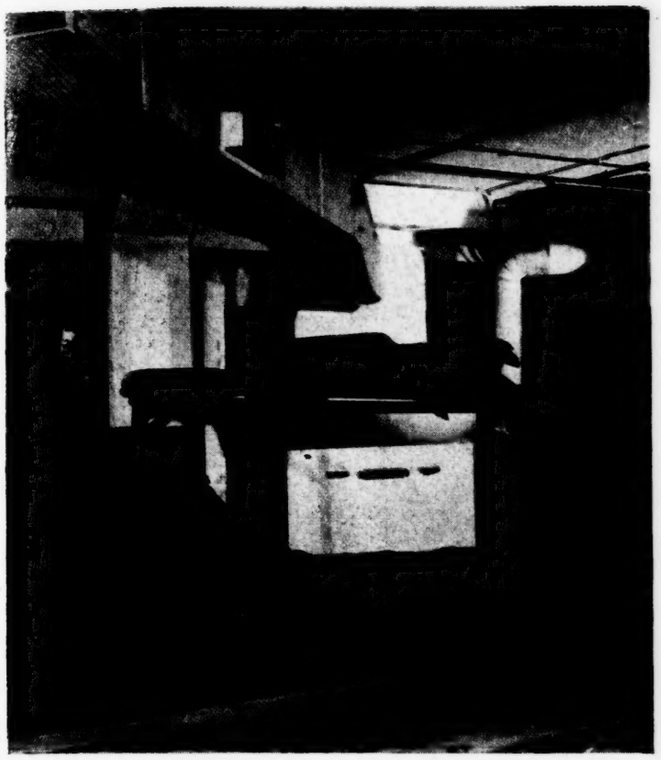


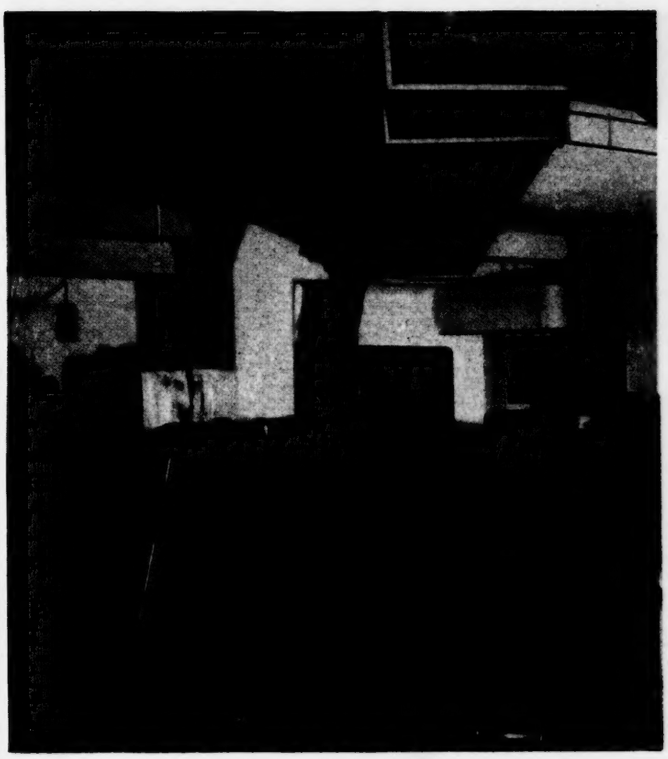
Patent Leather Processing

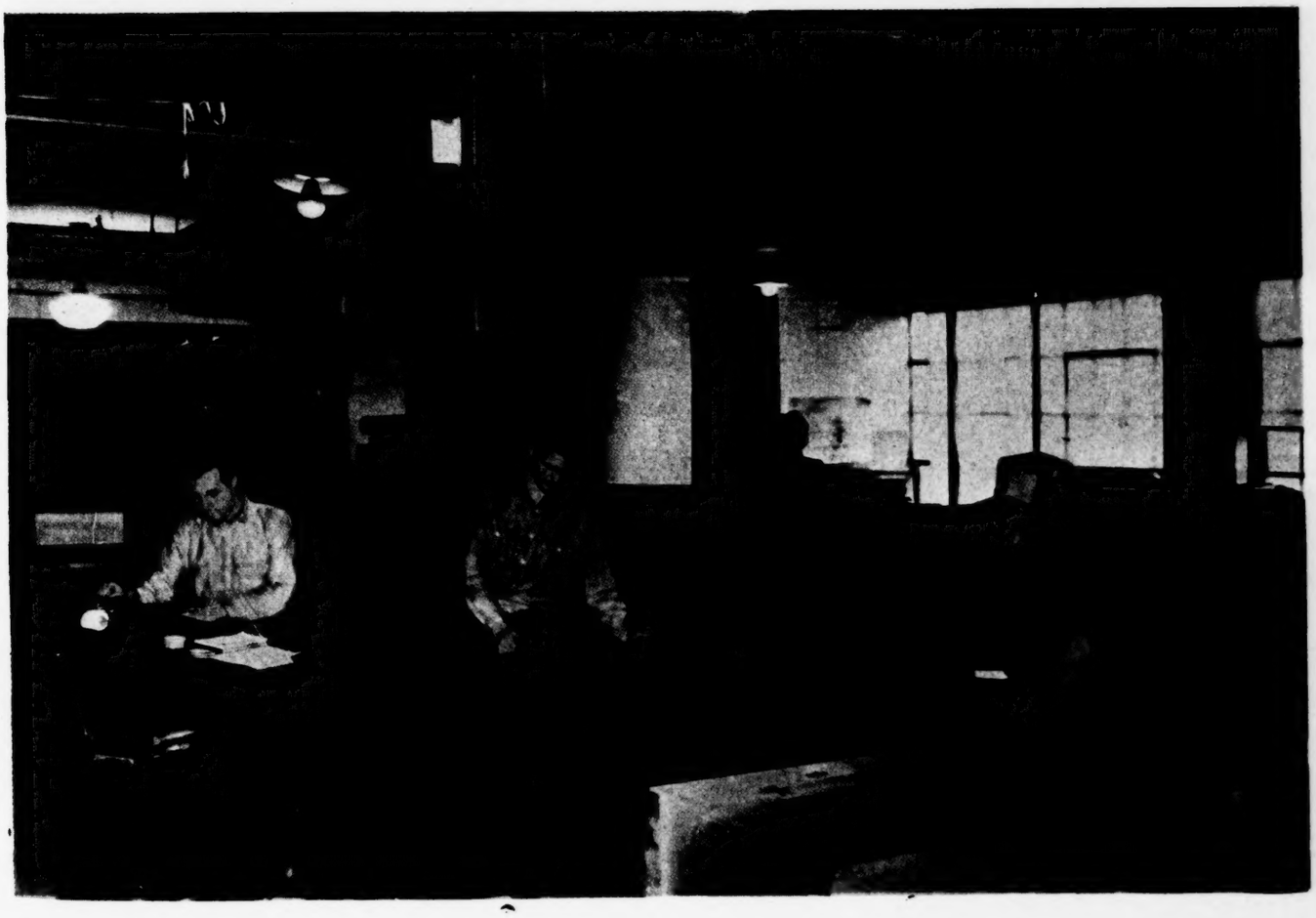
When received at the warehouse, the cowhides are sorted for grades and stored. This is done by stages, the workmen handling the leather in the coldest room first and then in slightly warmer rooms. It is stored at about 5F higher than when first handled, after first being wiped clean.

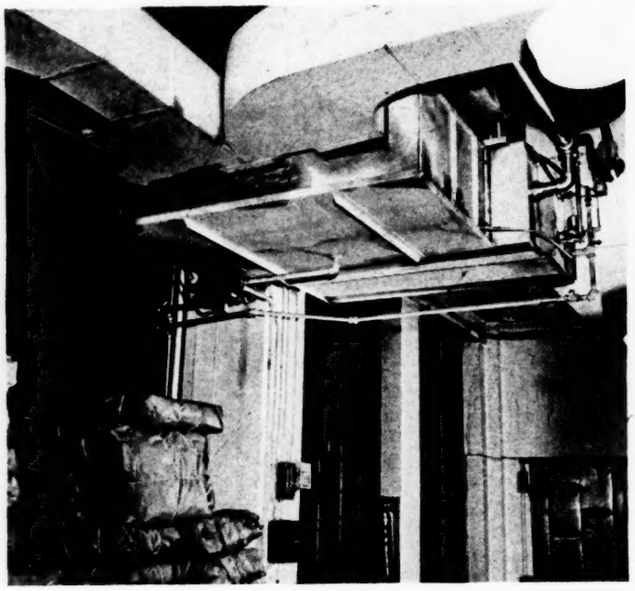
The leather then goes through a special tanning process that required about a month's time, after which it is made into the patent leather by applying two coats of special varnish. The first coat serves to fill the pores of the leather while the second is the finishing coat. Several days are required to apply and dry the coats of varnish. The varnish coating may be any color, although black and red are the favorites.

The varnished leather next is placed in ovens to dry

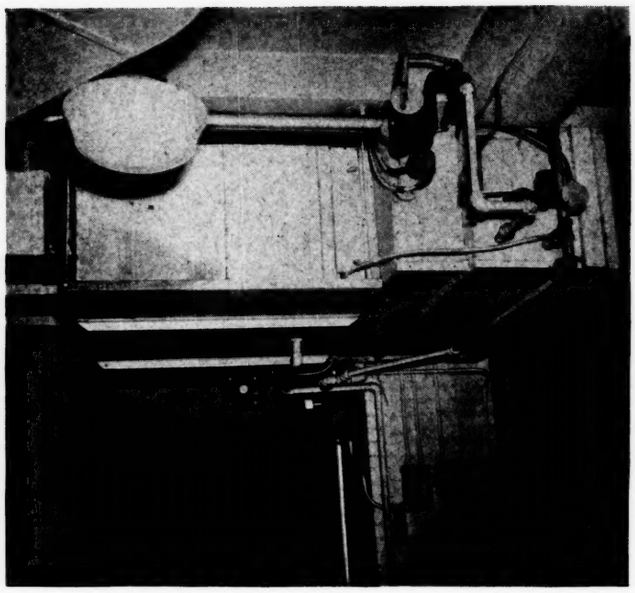








Air conditioning unit on the third floor consisting of filter, humidifier, and Aerofin coils. Through the coils refrigerant circulates in summer, steam in winter.



Air conditioning unit on the second floor. The Minneapolis-Honeywell motorized valve which controls the supply of steam to humidifier can be seen.

at a temperature of about 150F. The last factory process before shipment is to sun dry it. This is done to cure and mellow the leather and make it flexible as it is quite stiff when it comes from the ovens. As an extra precaution, for domestic buyers who store the material in their own factories and have no air conditioning, the finished surface is waxed. For shipment to the tropics, a square of cotton batting is placed between polished surfaces of two sides of the leather packed face to face, to keep the surfaces from adhering, since relative humidity in the tropics is one of the most troublesome factors in export business.

Benefits of Air Conditioning

Air conditioning has helped build up the business of this company from a modest capital of $21,000 to its present $1,000,000 and to an output of two million sides of patent leather alone. The company also sells other types of leather in various finishes and colors. It has agents all over the world in peace time and ships its products to 60 countries.

Were it not for air conditioning, a plant handling patent leather would have to cease production in the summer, in New England at least, owing to the high relative humidity. This would be very costly since a considerable demand for patent leather comes in the fall.

Air conditioning also helps to reduce the labor costs. Years ago a large crew of men were required to turn the leather by hand every day to keep it from sticking; with conditioned air this operation is not necessary.

Westinghouse Electric & Mfg. Co.

refrigerates a "testing igloo" where circuit breakers are set up and tested at —20F.

Circuit breakers are now being tested under actual service conditions in a huge refrigerated "igloo." With the outside temperature at 90F an outdoor type Westinghouse airblast breaker was set up and tested in the igloo at sub-zero temperature. The first series of tests was made at approximately 20F to find an efficient and satisfactory moisture trap. The next stage of the test was to introduce rain and note the effect of ice formation on the breaker disconnect switch. To accomplish this, a fine mist of water was sprayed and blown on the disconnect, the interrupter, and the seals of the mechanism housing. After ice was formed the breaker was operated. This test was made on three successive days and not once did the breaker fail to operate properly. Oscillograph records revealed that operating speeds were not retarded by ice formation. Water was deliberately sprayed into crevices in an attempt to stall the breakers. Refrigeration is accomplished by a York Ice Machinery ammonia refrigeration unit.

The igloo is a brick building 12 x 31 x 24 ft. The door, largest refrigerator door in the United States, weighs 2 tons and is insulated with six inches of cork under galvanized iron. Rubber and felt insulation prevent heat from coming in around the bottom of the door. The walls and ceiling of the "igloo" are covered with six inches of cork and one-half inch of cement plaster. The concrete floor base is topped with six inches of cork and another coating of concrete three inches thick. Two "peep hole" windows containing six layers of glass make it possible for engineers to look in without stepping into the —20F weather.

Freihofer Baking Co.

reduces time required for cooling bread 25%, obtains better crust and protection against "rope" by installation of cooler in its Philadelphia plant.

Bread in the conveyor belts immediately under the oven before entering the cooler.

By E. C. PFAFFHAUSEN†

IN order to obtain a uniform quality of bread and to insure profitable operation of the bakery it is necessary to use air conditioning in several parts of the baking process. One of the important parts of the baking process which requires air conditioning occurs when the bread leaves the oven and is cooled before it is sliced and wrapped. Usually the bread leaves the oven at a temperature of approximately 210F and it is desirable to have the bread properly cooled to a temperature of 90F before it is further handled.

Without the use of air conditioning the time of cooling and the quality of the bread varies. During the winter season the baker is able to cool the bread to 90F in approximately 90 minutes but during the summer season it requires from 2½ to 3 hours. With air conditioning it is always possible to cool the bread in 80 minutes no matter what the outside weather conditions. Air conditioning also gives the most desirable crust conditions. It is very desirable to have a soft crust condition in order to eliminate slicing and wrapping troubles. Bread which has cooled under the usual atmospheric conditions may have a crust which is too brittle to slice without flaking and cracking.

Temperature and humidity control are also important from the standpoint of maintaining the bread's flavor. Bread cooled in air conditioned spaces has a higher amount of moisture than bread cooled in non-air conditioned spaces—this not only gives the bread a better flavor but also makes it stay fresh longer. A further advantage of cooling under conditioned air conditions is that it helps eliminate mouldy bread. In certain localities during the summer bakers experience considerable trouble from bread moulding. This mould is caused by the spores present in the air being deposited on the bread during the cooling operation. With the use of air conditioning during bread cooling operation it has been found that practically all mould spores are eliminated and thus the baker who has an

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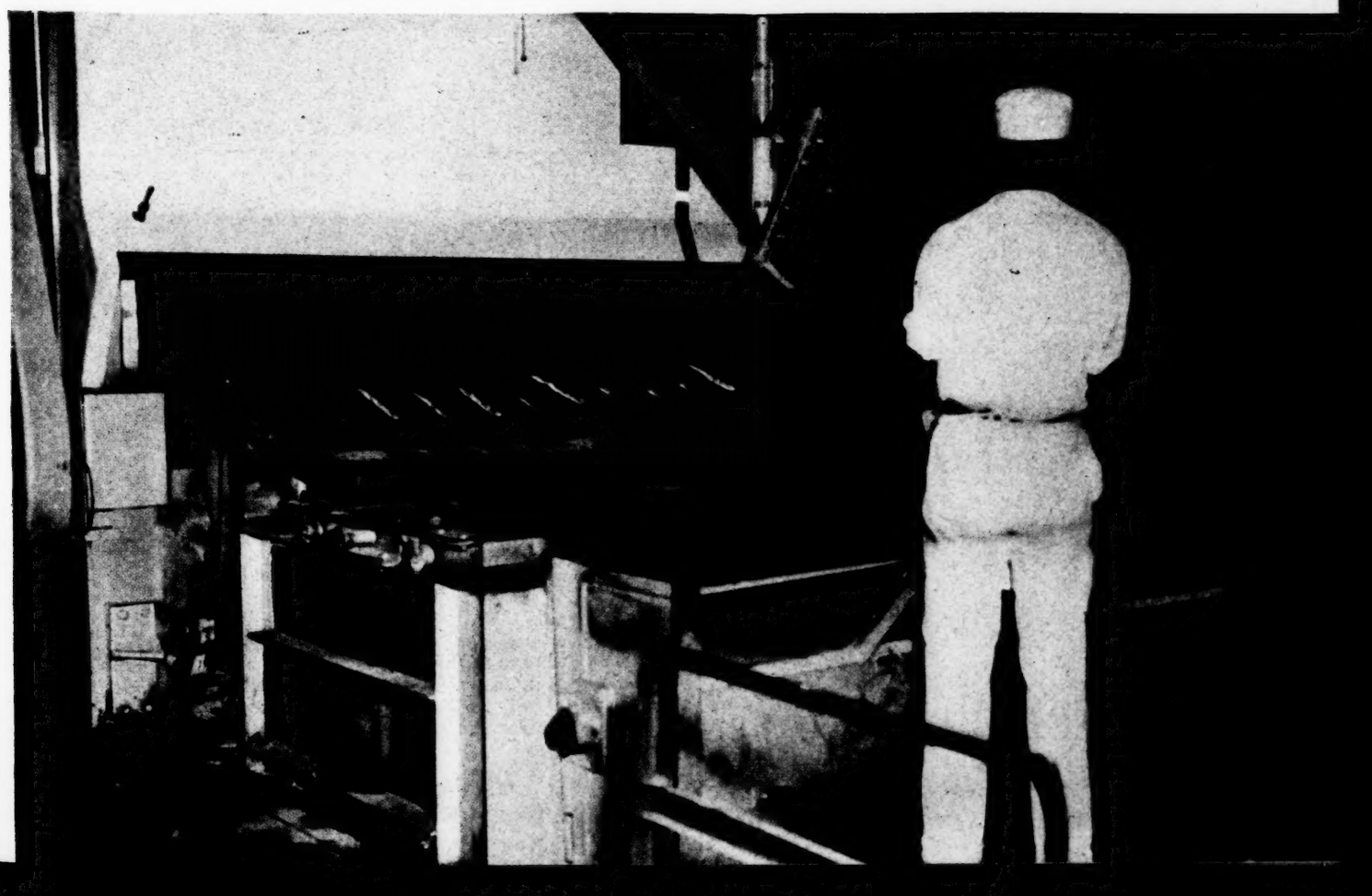
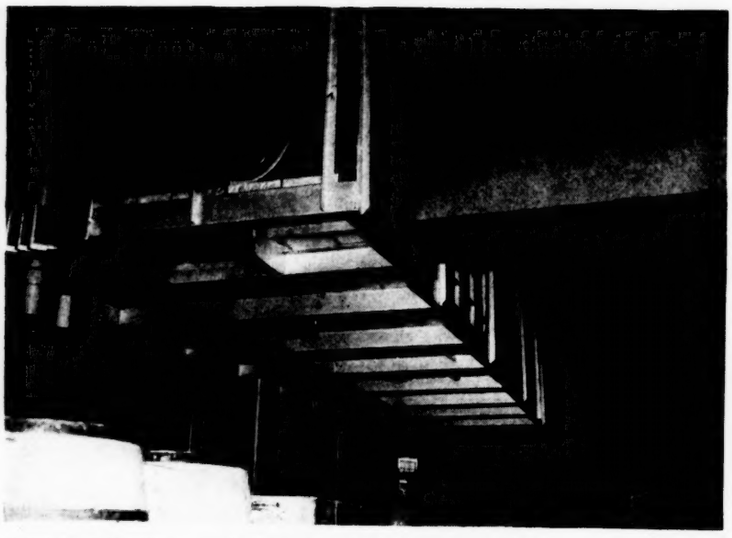
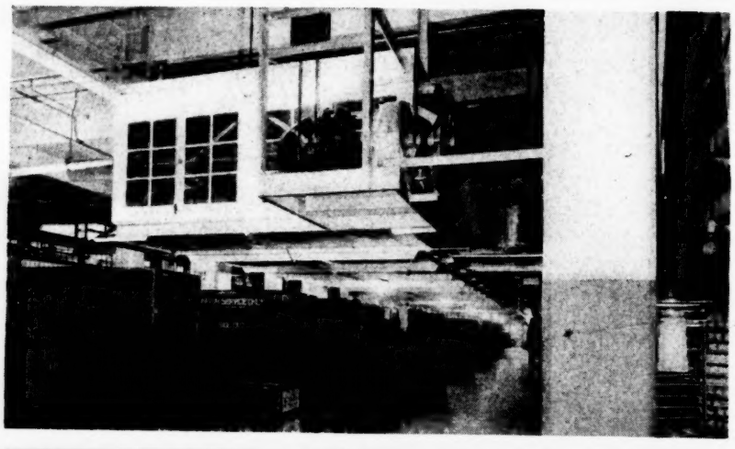
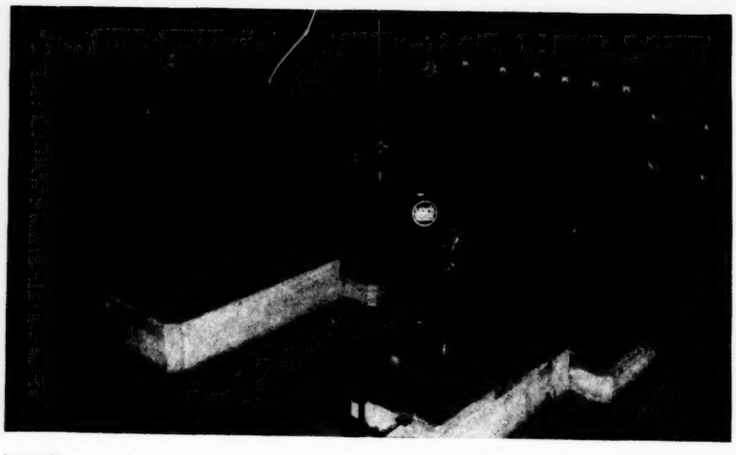
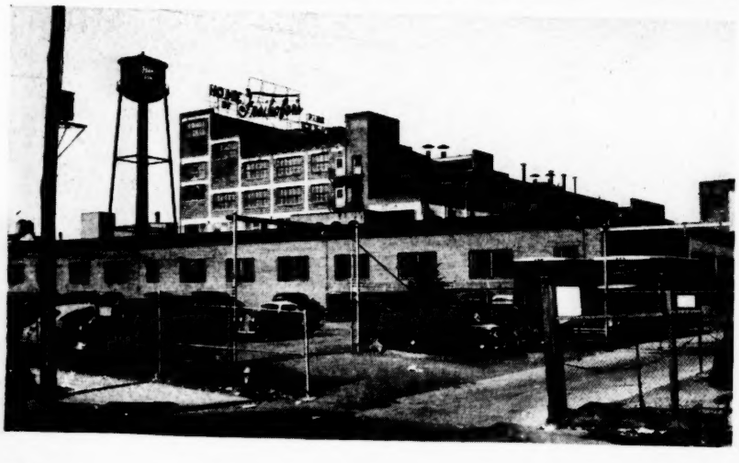
Bread leaving the ovens, located on the floor above the cooler. The bread is then dropped to a chute, thence when a guard on the chute is released, the bread slides to the conveyor belts, and to the cooler.

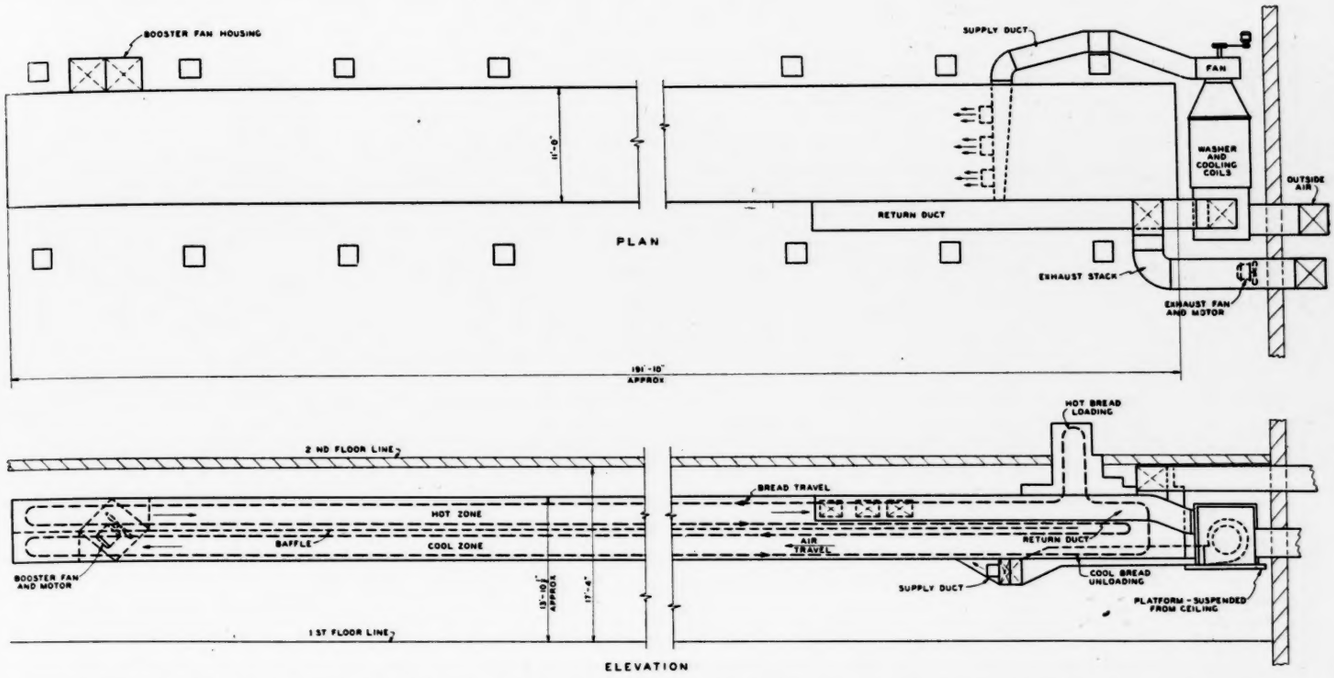












Plan and elevation of the bread cooler, in which the conditions maintained are regulated so that the dry bulb will approximate 73F. The speed of the conveyor is such that the cooling period from the time the bread enters until it leaves is approximately 1½ hours. The cooler has reduced cooling time approximately 25%. In addition to increased production, the product is superior to that which is obtained when cooled under normal atmospheric conditions; that is, the cooler enables protection against mold and rope in the bread and gives a softer crust which is essential in eliminating "checking" of the crust.

air conditioning bread cooling system eliminates his mould problem.

In order to obtain the above results there is installed at the Philadelphia plant of the Freihofer Baking Company a complete bread cooling system. This bread cooler is manufactured by the Baker Perkins Company and capable of delivering 5000 twenty-two-ounce loaves of bread per hour. The bread cooler takes the bread from the oven on the second floor and delivers it to the slicing machines on the first floor, cooling and conditioning it during the conveying process.

Bread Cooler

The cooler is of a conveyor type and is approximately 10 ft high, 11 ft wide and 190 ft long. The sides of the cooler are made of wood sash and the bottom of sheet metal. The cooler is divided into two zones by a sheet metal baffle which runs horizontally the full length of the cooler. The top section is known as the hot zone and the bottom section is known as the cool zone.

After the bread is taken from the oven it passes the full length of the cooler four times, twice in the hot zone and twice in the cool zone.

The conditioned air is delivered to the leaving end of the cool zone. This air is blasted into this zone and travels approximately 190 ft or to the far end of the bread cooler where it is picked up by a propeller type booster fan and then blown back into the hot zone of the bread cooler. The air again travels '90 ft to the point where it is picked up by the recirculated air ductwork and is either exhausted to the outdoors by an exhaust fan or is recirculated through the air washer apparatus. This method of air distribution is practically counter-flow in principle—the cool air coming into contact with the cool bread and as this air is warmed up by the heat of the bread, it comes in contact with hotter bread, thereby preventing cracking of the crust of the bread.

Air Conditioning

The air conditioning equipment consists of a Drying Systems' design and construction air washer made entirely of copper with brass pipe and brass nozzles. A Deming-Mueller 3 hp pump and motor, for recirculating the water from the washer tank to the spray nozzles, is used. Inside the air washer is a series of Trane Company copper fin, copper tube cooling coils to which is supplied chilled water at 40F.

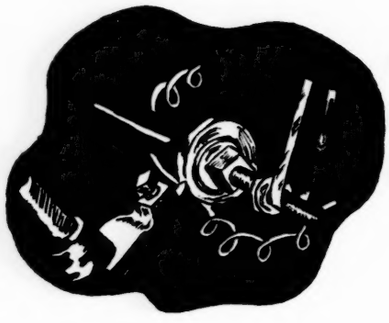
The refrigeration load on this system, during the extreme out-of-door conditions, is approximately 40 tons. The supply blower to the system is an American Blower Company Sirocco fan driven by a 10 hp motor.

Control

The automatic control consists of a Minneapolis-Honeywell thermostat, electrically operating damper motors which regulate the amount of fresh air and recirculated air brought into the system during most of the year and also regulates the amount of chilled water entering the cooling coils during the extreme summer days. The best results obtained in bread cooling are with an air delivery temperature of 73F dry bulb. The wet bulb setting is determined by the operating engineer and set at the most desirable point for the type of bread being cooled.

This bread cooling system is in operation 24 hours a day and approximately six days a week, and the Freihofer Baking Company has experienced all the desirable benefits which sum themselves in one idea, namely: "Uniformity of the finished product."

Ford Motor Company



air conditions its new Pratt & Whitney Engine Plant to make possible future blackout, to eliminate dust damage to fine finishes and to insure extreme accuracy of machined parts.

By GEORGE McNAMARA†

ONE phase of the Ford Motor Company's activities under the national defense program involves the construction of large numbers of Pratt & Whitney 18-cylinder, 2000 hp aircraft engines. A year ago when the Ford Motor Company took the contract to build these engines they immediately started the construction on a vacant site at their River Rouge plant of a large building which would be devoted exclusively to the production of these engines. Originally the building was planned to be about 1000 ft long and 360 ft wide with a wing for testing engines approximately 75 x 700 ft. After construction was started, however, it was decided to increase the length of the main building.

There are several unusual features in this building. First of all, it is completely air conditioned; second, it consists of a factory building within another building, the space between being used for the offices and utility rooms. And third, it was housed in a large temporary building during construction.

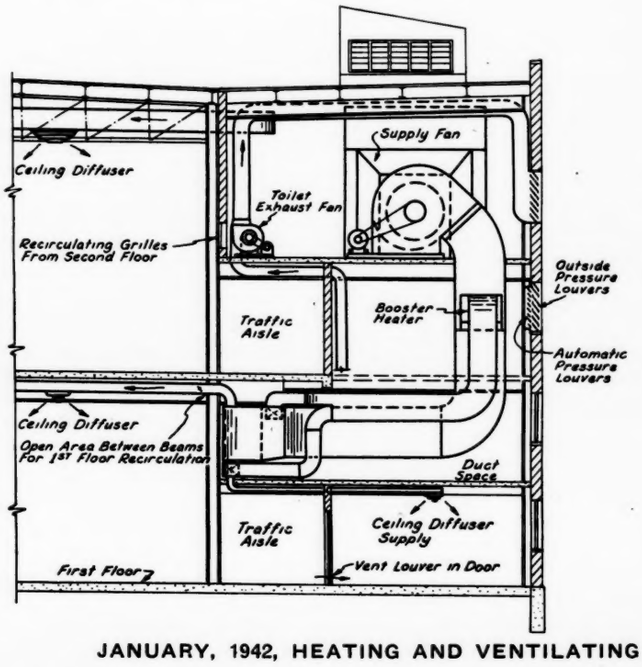
The exterior of the building consists of brick with two lines of steel sash on the front and four lines of steel sash on side walls. Located in the line formed by the steel sash are air exhausts and at these openings metal louvers are substituted for the glass. An interesting feature of the exterior of the plant is that all of the glass windows may be easily replaced with metal panels in case it is ever desired to convert the building into a blackout factory.

Cross-section of 30-ft side section of plant which houses the air conditioning equipment, offices, lunch and locker rooms. Note that air conditioning rooms are on second floor mezzanine.

Temporary Protection

In order that the construction of the building might proceed with the utmost speed during the winter, the Ford Motor Company erected what has been popularly called the biggest box in the world. This was a temporary stud and celotex enclosure which completely enclosed the permanent structure. A temporary heating system consisting of high pressure unit heaters was provided within the box so that there might be no delay in the erection of materials, pouring of concrete, etc. To achieve this, a steam supply and steam return line were run from present service mains in the adja-

†Anemostat Corporation of America, Detroit.



cent building. Two sizes of blower type unit heaters having capacities of 750,000 Btu per hr and 225,000 Btu per hr were arranged on the two floor levels. These units were suspended from the beams by temporary *clamp* type hangers. At the completion of the job, the aforementioned steam supply pipe was reused as a water supply to the building, while the return line was used as a steam return for the permanent heating system. By this means, very little is wasted in providing for the temporary heating system.

With the winter hazard completely eliminated, this meant that the building could be rapidly completed. This weatherproof shell made possible the completion of the building in less than eight months from the time the contract was awarded.

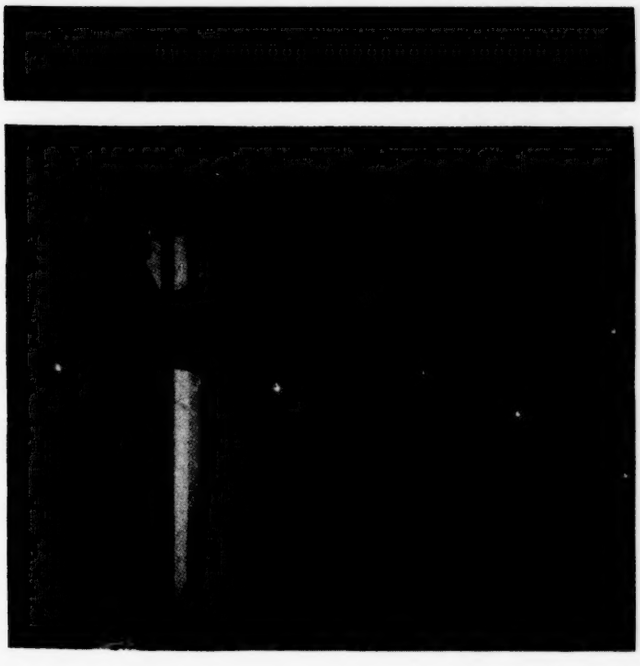
Aircraft Engine Training School

The front 58 ft of the building is occupied by a three-story section which houses the aircraft engine training school. This section includes classrooms, offices, laboratories and dining spaces set aside for training apprentices and mechanics in the theory and practice of aircraft engine construction.

Office Section

Along the two sides of the plant, 30 ft sections are occupied by office facilities, toolrooms, corridors, fan rooms and utilities. These sections have four stories, the first used as office and lunch rooms, the second story (first floor mezzanine) for lunch and locker rooms and duct spaces, the third story (second floor) for offices, coat and lunch rooms while the fourth story (second floor mezzanine) is used for fan, lunch and locker rooms.

In back of the front section and in between the side 30 ft sections is a large area devoted to aircraft engine production. This two story space is thus enclosed by surrounding offices, classrooms and similar rooms and can be considered as a windowless plant.

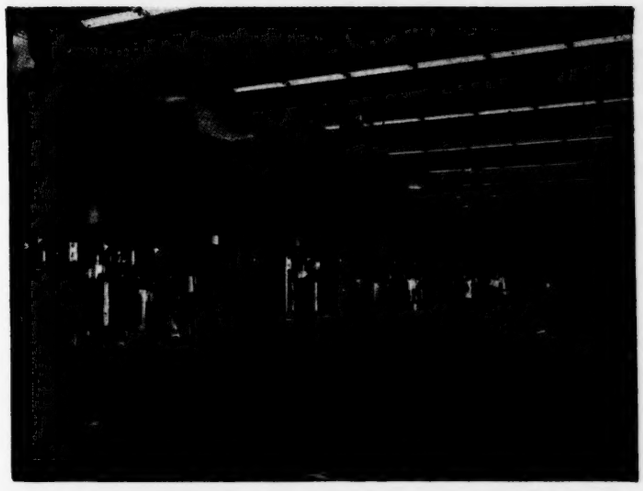


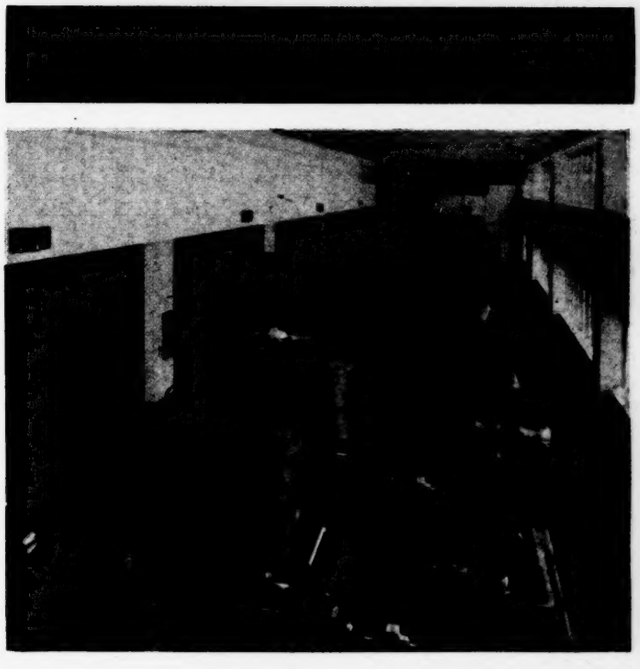
Production Area

The first story of the production plant is devoted to assembly and manufacturing work other than the machinery operations which are all performed on the second floor. While there is no basement beneath the building there are a number of large underground rooms and tunnels to accommodate the various items of equipment and utilities which could be best placed beneath the first floor.

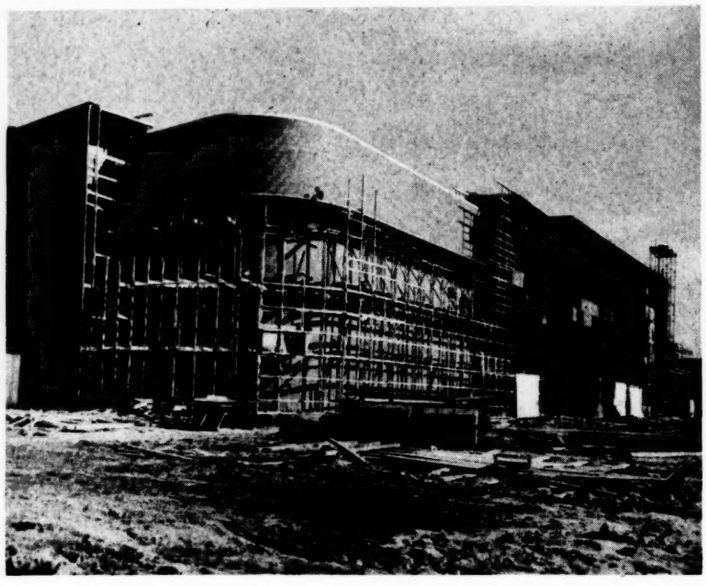
Reasons for Air Conditioning

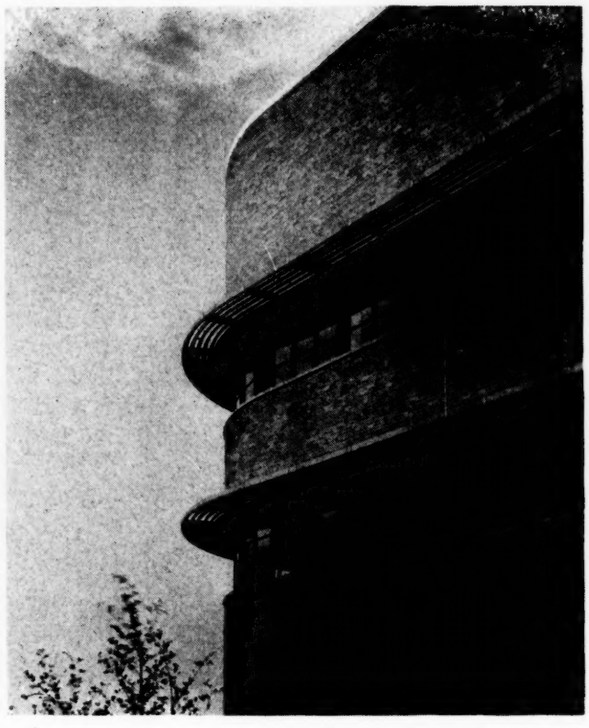
It was decided to air condition the plant for a number of reasons. First of all, by having the plant completely air conditioned there would be no difficulty in blacking out the plant in case it is ever necessary. Second, the industrial atmosphere around the plant causes the air to be quite dusty and air conditioning helps prevent the dust from spoiling the fine finish nec-





(Below) View during construction showing removal of the temporary building which made it possible to carry on building operations during the winter months. (Right) Closeup of the enamel steel louvered awnings which serve to shade the windows without restricting light.





essary on aircraft engine parts. The third and very important reason for air conditioning is that it makes possible the extreme accuracy required in aircraft engine production.

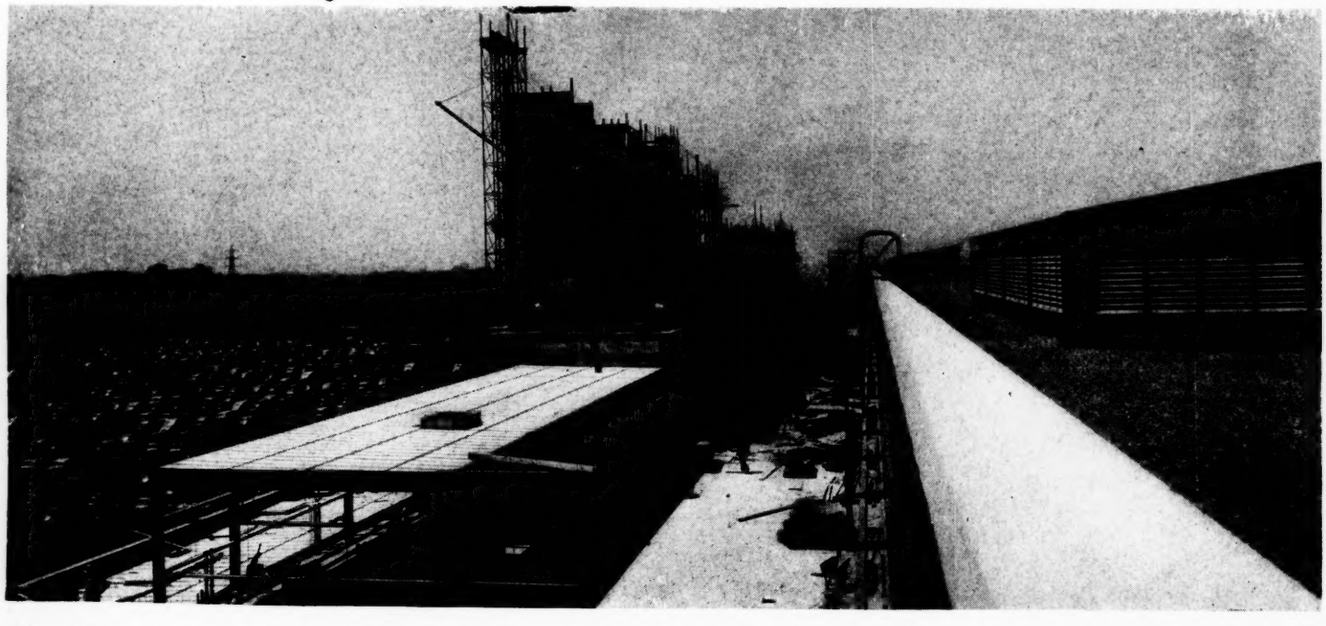
Air Conditioning

The air conditioning system for this building is divided into two parts; one serving the aircraft training section while the other serves the production area.

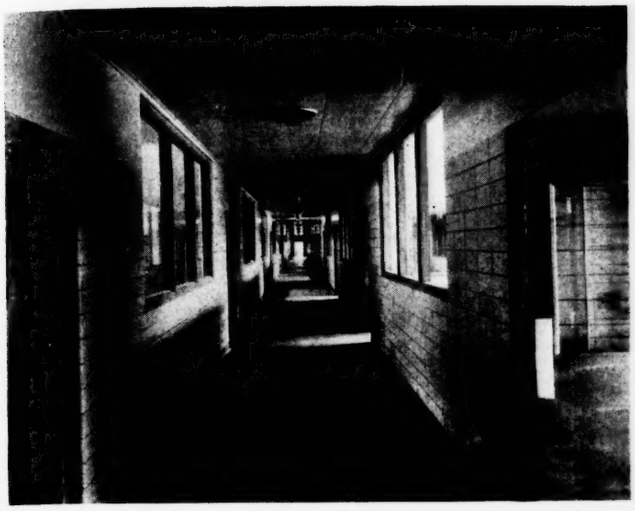
Factory Air Conditioning

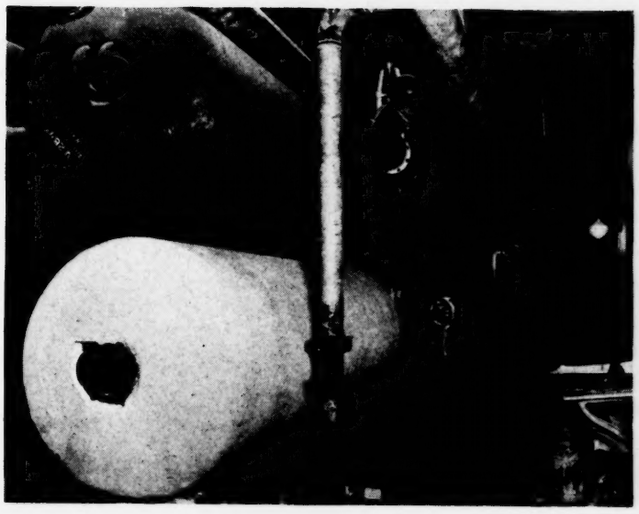
The factory portion of the building is divided into eight main zones and 32 sub-zones. Four fan rooms on the second floor mezzanine serve the main zones. Each of these fan rooms is equipped with four separate air conditioning units, each conditioning unit supplying a separate sub-zone. Of the four air conditioning units in each fan room, two supply sub-zones on the first floor and two sub-zones on the second floor. The separate air conditioning units are identical although they may vary in size from 36,000 to 65,000 cfm.

In all there are thirty-four air conditioning units located on the second floor mezzanine level, 32 for the factory area and two for the aircraft engine training area. Each unit consists of filters, water cooling coils, steam coils, humidifying spray eliminators and a fan.



View of the side of the building during construction showing engine test cell building. At the right can be seen the air intake penthouse for the air conditioning units.





(Left) Corridor in the aircraft training section showing ceiling type air distributors. (Right) View in one of the basement rooms during construction showing large storage tanks and welded pipe.

Steam at 150 lb pressure is supplied to the steam coils from the central power plant located a mile away while chilled water is supplied to the water cooling coils by means of four 2200 gal centrifugal pumps from a machinery room in the basement.

Since the fan rooms are located on the second floor mezzanine, just beneath the roof, all of the outside air is brought into the building through penthouses on the roof. The recirculated air from the second floor enters the fan room through grilled openings in the fan room wall while the recirculated air from the first floor reaches the fan room through a duct on the first floor mezzanine. The outside and recirculated air is mixed in the desired proportion before it enters the air conditioning unit.

The mixed air then passes through a perforated plate which helps distribute it evenly over the surface of the Electromatic filters. It then passes through a spray chamber which is used only during the winter months for humidifying, then through Aerofin cooling coils which are mounted horizontally six rows deep.

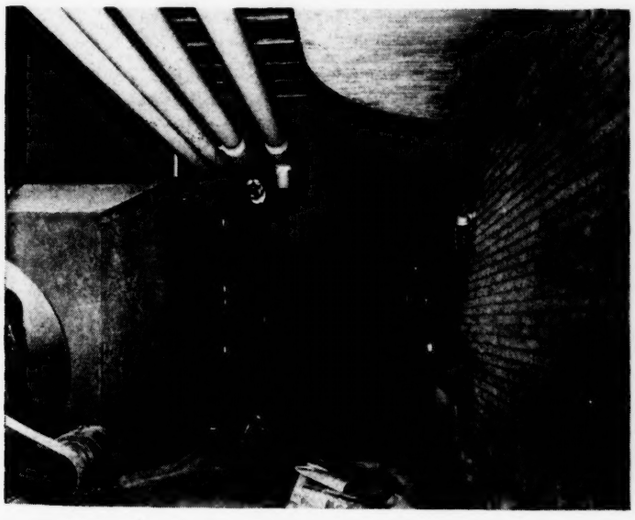
These coils are the cleanable tube type with removable header plates for access to the tubes. All piping connections in these coils are made at the side of the header so that the plate may be removed for servicing the tubes without disturbing the piping connections.

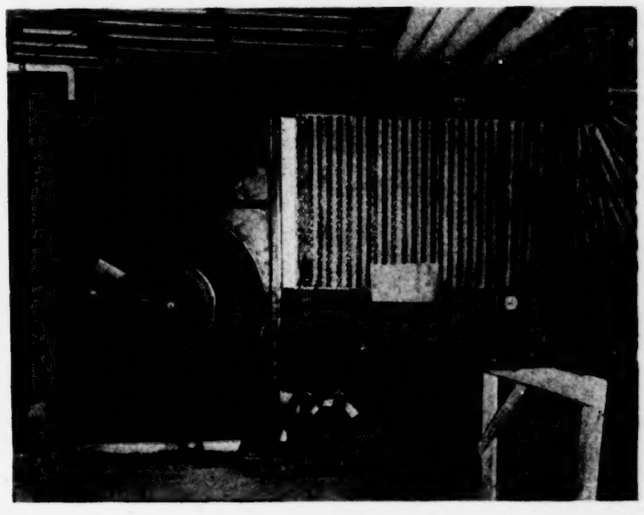
The air then passes through Aerofin steam coils which are used for heating the air in the winter or for reheating it during the summer when it is necessary to overcool the air for dehumidifying purposes. A Sturtevant fan then delivers the air through a duct supply system to the conditioned areas.

Air Distribution

The air for the second floor is carried through ducts directly to Anemostat ceiling diffusers while the air for the first floor is carried in a duct to the first floor mezzanine and from this mezzanine out through ceiling ducts to the production area.

To supply the air to the factory area the Anemostats are mounted at an 18 ft height at a level with the base of the truss. On the second floor there are 270 Anemostats, each handling approximately 3750 cfm and cov-





(Left) One of the air conditioning rooms. Note the use of Masonite board for air conditioning housing. (Right) One of the large fans used for distributing conditioned air to various work spaces.

ering an area of 50 x 30 ft while on the first floor there are 498 Anemostats, each handling 1500 cfm and covering an area of 30 x 25 ft. It is interesting to note that approximately 350 tons of sheet metal and 63 tons of angle iron were used in the fabrication of the ducts in spite of the fact that high air velocities were used.

The air not recirculated to the fan rooms passes through pressure louvers through the exterior wall of the first and second floors.

Refrigeration Equipment

The chilled water for the 34 air conditioning units is cooled by six 1000-ton York centrifugal compressors located in the machine room on the first floor. Such a figure sounds insignificant in print, but when we think that the system is capable of handling a refrigeration load of 48,000,000 Btu per hr we begin to enter into the fantastic range of figures involved in such an installation. In ordinary installations, what engineer has not looked at a 100-ton compressor, and inwardly admired the manufacturer for combining so much power and precision work into one machine. Then, compare these machines, each having ten times the power of that in question and each covering a floor area of approximately 16 ft x 18 ft and standing 16 ft in height.

These compressors are turbine driven by Murray steam turbines, of the single stage type. However, the design of these turbines is such that the load may be varied from practically no load to a capacity of 1200 hp. A steam turbine drive was selected because there was available a large amount of waste steam at pressures of 150 lb and temperatures of 550F during the summer.

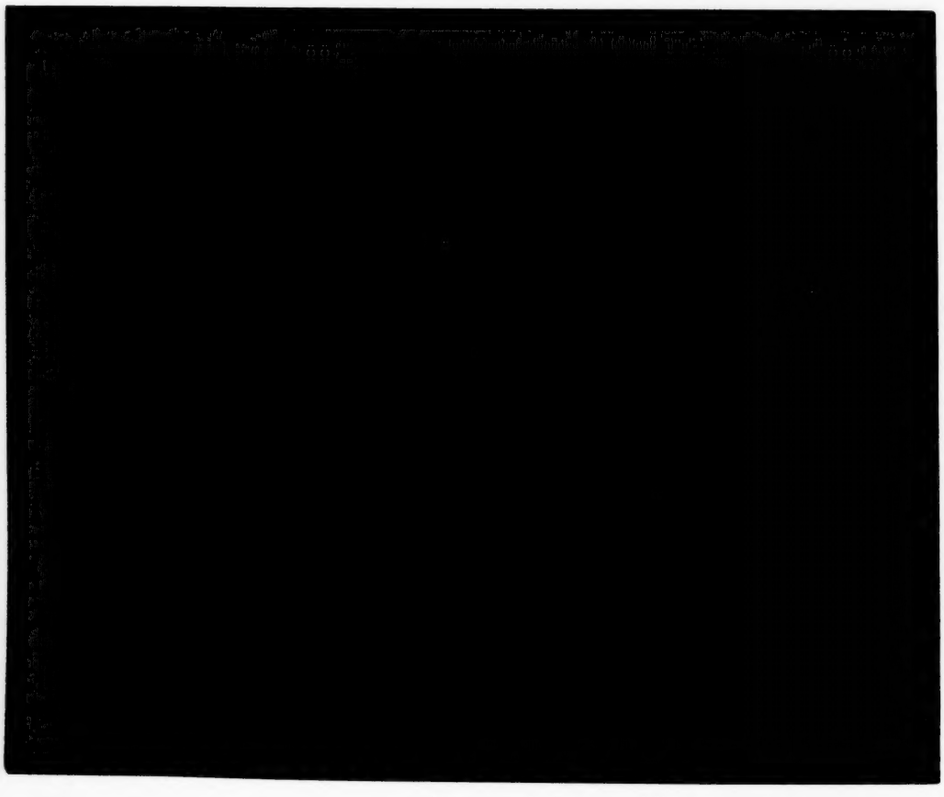
Allis Chalmers shell and tube condensers, one for each unit, are located in a basement room directly below the machine room. Two 24-in service pipes supply mill river water to these condensers through two Elliott strainers, each capable of handling 5000 gpm. One strainer acts as a standby under normal conditions. The mill water first runs through the shell and tube condenser on the refrigerating compressors and then through the turbine condensers, after which it is then wasted to the sewer.

In the same room with the condensers, are located the four Worthington centrifugal pumps, that circulate the chilled water throughout the building to the cooling coils. Each pump has a capacity of 2200 gpm and all four are interconnected by a header arrangement so that any pump may serve any compressor. The chilled water, steam, hot and cold water, compressed air, and other services are distributed through a system of tunnels throughout the building.

Control

In the design of such an elaborate system, the success of its operation depends on the system of automatic control. The Johnson Service Company assumed the responsibility of installing a system of pneumatic control, to meet the specified requirements. As mentioned hereinbefore, each zone is served by its own air conditioning unit. Thus, with 32 zones in the factory portion, this meant 32 systems of automatic control for that area. These controls function as follows:

A room type thermostat maintains the temperature in each zone by controlling pneumatically operated steam and chilled water valves on the coils in sequence. That is, with call for cooling in the zone, the thermostat opens the chilled water valve in the supply line to the cooling coils. However, if heat should be required, the same thermostat swings over and controls the steam valve on the heating coils.



Plan of a section of the building showing method of distributing the air. Note that air conditioning units are located in side 30-ft sections.

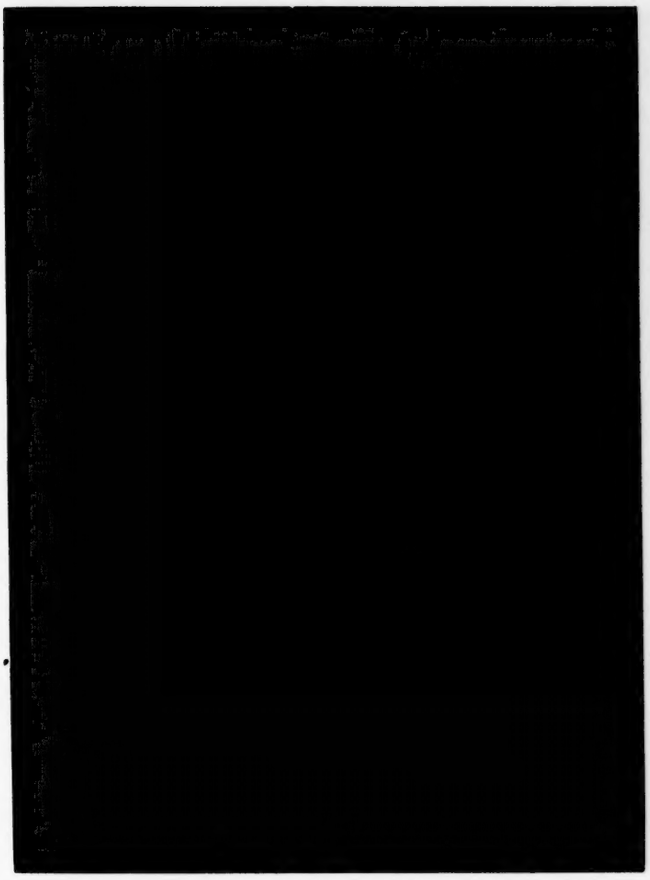
A room type humidistat maintains constant humidity by controlling the steam valve on the water heater, the recirculating pump supplying water to the spray chamber and the chilled water valve on the cooling coils. During the winter season, the humidistat starts and stops the spray pump and operates the steam valve on the heater simultaneously with call for humidity. In the summer cycle, the humidistat takes control of the chilled water valve on rising humidity while the thermostat controls the steam valve on the heating coils to reheat the air in case of over-cooling resulting from the necessary dehumidifying.

At all periods of operation, a 25% minimum fresh air damper opens and closes with the starting and stopping of the supply fan. The 75% maximum fresh air damper remains closed until the wet bulb temperature of the outside air drops below that of the inside air. This condition is sensed by a combination dry bulb thermostat and humidistat inserted in the fresh air stream, which immediately closes the recirculated air damper, and opens the maximum fresh air damper, to take advantage of the lower total heat content of the outside air. The excess air thus delivered into the building is relieved through back pressure dampers in the outside walls. In such a large installation, this results in a considerable saving in operating expense.

In connection with the above, an insertion thermostat in the fresh air stream closes the chilled water valve as the outside air temperature drops below 60F dry bulb, and permits operation of the steam valve to the water heater and the circulating pump for the spray chamber. Conversely, as the outside temperature rises above 60F dry bulb, the chilled water valve is put into operation, and the steam valve and circulating pump are cut out. In extremely cold weather when outside air is required for cooling a second insertion thermostat in the fresh air stream takes control of the 75% fresh air damper modulating it with the recirculated air damper to maintain a mixed temperature in the intake plenum of 44F dry bulb.

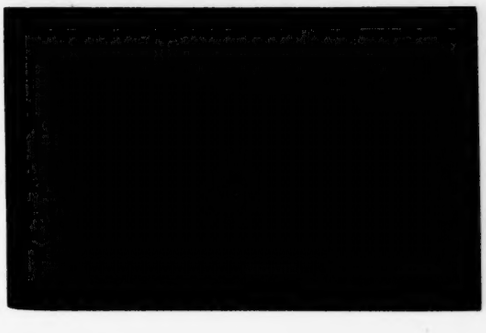
Aircraft Engine Section

The two air conditioning units serving the aircraft training section function essentially the same as the above description for the factory zones. However, in this case, with the use of the *blow-through* principle, each zone has its own coils. This portion of the building is divided as follows: The outside section of the building on the first and second floors is divided into two zones, each being served by that conditioning unit on its side of the building. This principle is repeated for the inside section of the first and second floors. On the third floor the cafeteria section is treated as one zone, while the opposite end of the building is divided into two zones. Here again, the controls function essentially the same as described for the factory section, each zone having its own thermostats. However, the humidity for this entire portion of the building is controlled by two humidistats, one serving each air conditioning unit as described previously.



Cross-section of the side 30-ft section showing how the conditioned air is distributed.

The entire installation serves to make this one of the most complete and modern manufacturing buildings in the industrial field at the present day. It provides the workmen with ideal working conditions from both the physical and the medical point of view, by maintaining constant temperatures and humidities throughout the entire year. This in no small way further contributes to the utmost perfection in the precision work required in aircraft engine manufacture. There is no doubt that this company is not only proving itself an important factor in the program of national defense, but is also contributing a tremendous advance architecturally in modern design of industrial plants. With such leaders in the field, we may confidently look forward to the time when our large industrial plants will compete in efficiency, cleanliness, and health of the workmen, with the most modern office building of the present day.



W. F. Hall Printing Company

employs compressor-cooled water to reduce temperature of paper (on high-speed presses) previously heated to dry the ink, and obtains economical cycle of operation the year round.

By ROBERT E. HATTIS†

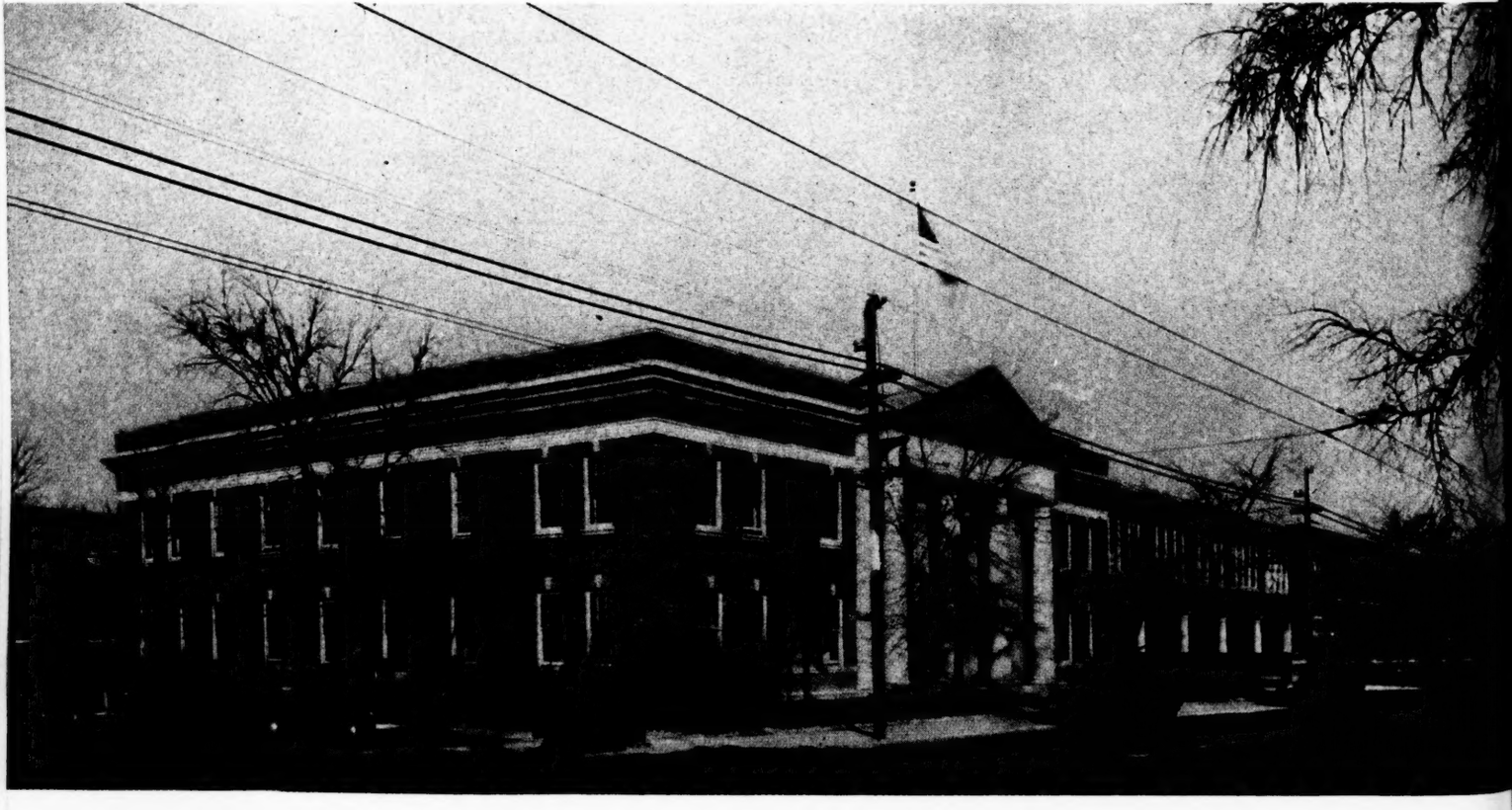
A NOVEL application of air conditioning equipment is used in a new economical printing process at one of the largest printing establishments in the nation. At the W. F. Hall Printing Company in Chicago, Illinois, huge rotary four-color presses print both sides of a web paper simultaneously with the paper traveling at high speeds. In order to eliminate all possible chance of smearing or smudging at these high speeds, the ink must be dried. Gas-fired dryers are used, and the paper leaves these drying rolls at the relatively high temperature of approximately 300F. In order to maintain the accurate registering of colors the paper must be cooled to the normal temperature. This cooling process is achieved by rapidly passing the paper over a water cooled roll on the printing press.

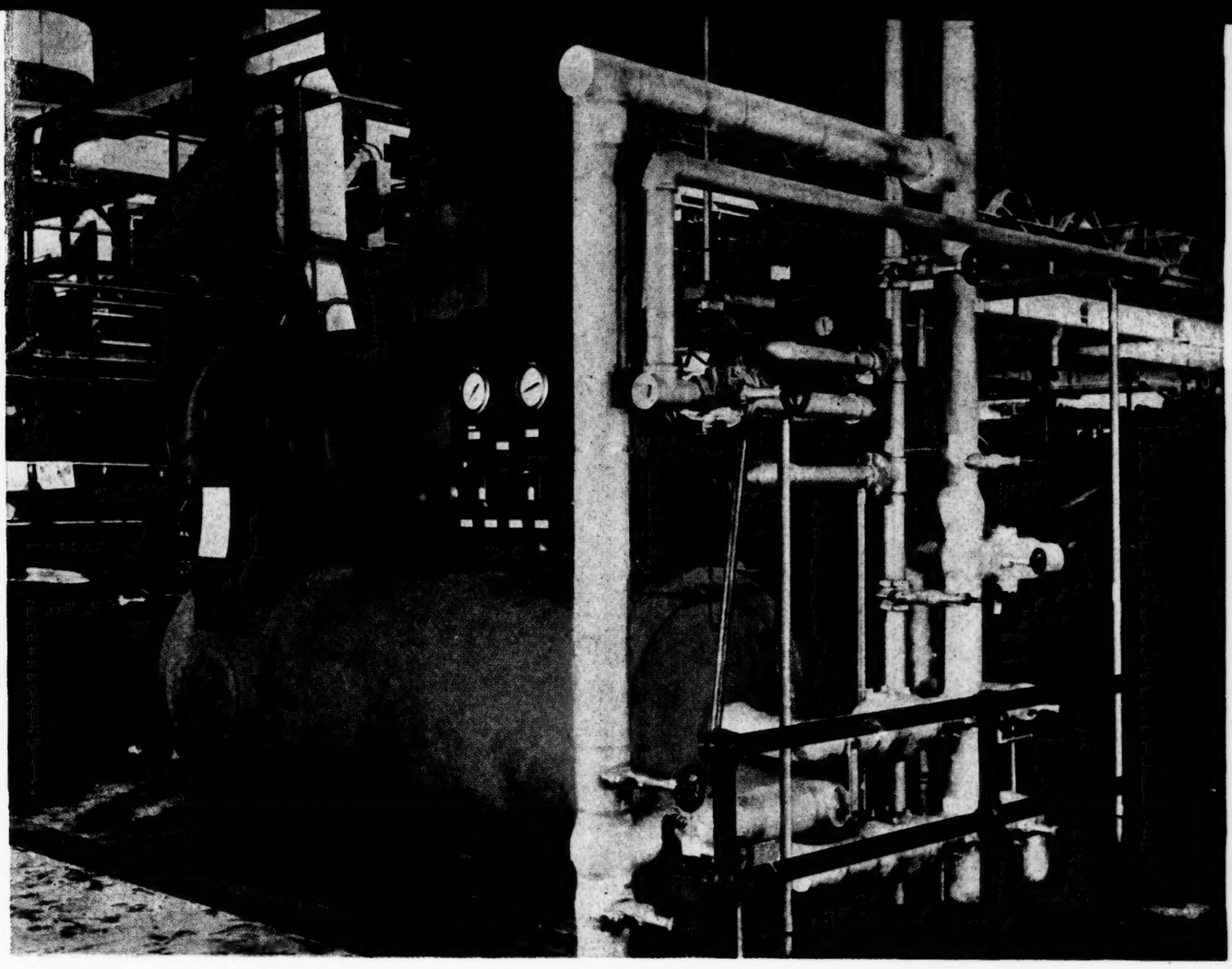
In order to cool the paper with sufficient rapidity, water at 50F must be supplied to the cooling rolls. Although water below this temperature can be obtained from the city mains in Chicago for six months of the year, during the summer months the temperature of the city water rises as high as 72F. At first well water was considered until it was found that the average temperature of the well water available in the vicinity was 62F. Therefore, if either well water or city water were used, it would be necessary to cool the water to 50F.

The use of well water would require the operation of cooling equipment the entire year, whereas the use of city water would require the use of cooling equipment for approximately only six months of the year. In addition, the cost of installing a well plus the cooling equipment would materially increase the first cost

†Consulting Engineer, Chicago, Ill.

W. F. Hall Printing Company, Chicago, one of the largest printing establishments in the country. The plant is equipped with huge rotary presses which print four superimposed colors simultaneously and continuously on both sides of a web of paper traveling at high speed and delivers the product, cut and folded, into suitable page size units.





Close-up of the cooling unit which supplies chilled water to the cooling rolls of the rotary presses. The chilled water restores the paper to a normal temperature following the drying of the ink by heating. Whenever the operator starts the press, the cooling unit is automatically started.

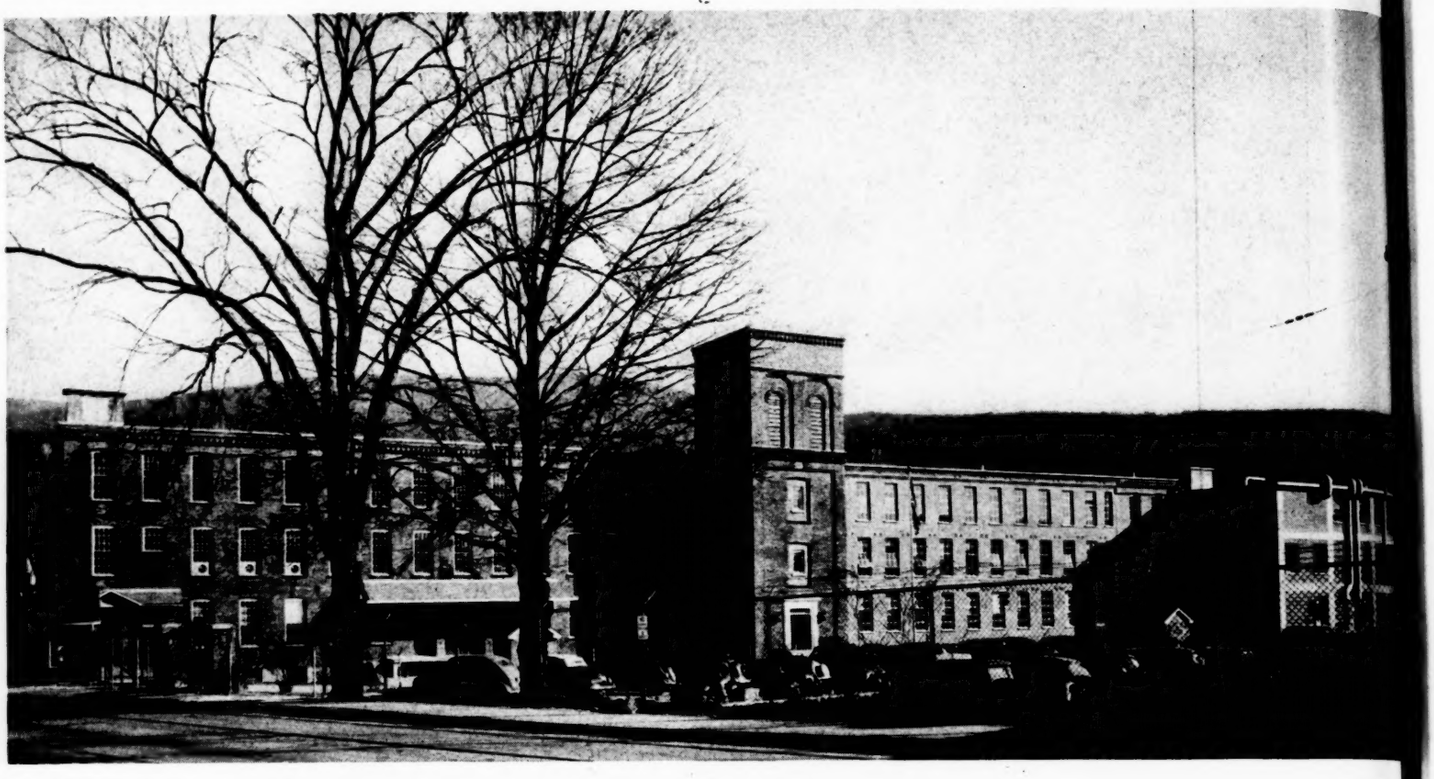
of the installation. Furthermore, when the operating cost and the fixed charges on the investment of the well were computed, it was found that the saving was too small to warrant the sinking of a well. Moreover, well water is very much harder than the lake water supplied by the city of Chicago. Inasmuch as the water is heated to approximately 100F or more in the cooling rolls, the harder well water would have meant greater difficulties with scale deposits inside of the cooling rolls. For these reasons, the use of city water with cooling equipment was finally decided upon.

In order to avoid extra labor costs, the management of the W. F. Hall Printing Company specified that the plant for cooling the water be entirely automatic in operation. In other words, whenever the operator started the press, the cooling unit was to immediately go into operation and start cooling the water to the cooling rolls.

After carefully examining the equipment available for cooling water and considering the need for fully automatic operation, it was finally decided that the hermetically sealed, centrifugal unit, Trane Turbo-Vac compressor, would best meet the requirements of this job. The unit installed has a capacity of 70 tons when cooling water to 50F. This unit requires 70 hp divided between two 35 hp motors. It is completely automatic in operation and, in addition, has means for automatically varying the capacity in accordance with the load.

Inasmuch as the highest temperature at which city water is supplied is 72F and because the water leaves the rolls at a temperature of about 100F the water is not recirculated in the rolls. Instead a continuous supply of city water at 72F is supplied to the cooling unit. The city water chilled to 50F leaves the cooling unit and is delivered to the cooling rolls of the printing presses. In the cooling rolls, the water heats up to approximately 100F. The water leaving the cooling rolls is mixed with city water and the mixture is supplied to the condenser of the compressor. After leaving the condenser, the water is piped to air washers through which the exhaust gases and products of combustion from the dryers are passed in order to remove all objectionable fumes and odors before being discharged to the atmosphere. The water from the washers is discharged to the sewer.

From the foregoing description, it is apparent that because of the multiple use of the water, an economical cycle of operation is achieved. Furthermore, the use of the centrifugal cooling unit, which is self-contained and hermetically sealed, made a simple automatic installation possible. The Turbo-Vac compressor is installed adjacent to the presses which it serves, and the piping runs were thereby kept relatively short. It is now in its third summer of operation and is giving admirable performance and complete satisfaction.



Gevaert Company of America,

photographic supply manufacturers, air conditions to obtain 24-hour control of air volume, temperatures, humidities and cleanliness, using a five-zone system and steam heating plant. Collapsible, wool-lined ducts used.

By J. J. GOOVAERTS†

THE new factory of The Gevaert Company of America, located in the Berkshires in Williamstown, Massachusetts, offers some rather interesting experiences in heating, ventilating and air conditioning due to the extreme sensitiveness of their products to light, movement of air and dust particles, temperature and humidity. In the manufacture of these products, which include all types of photographic films, dry plates, sensitized papers, etc., the control of all factors of light and air is absolutely necessary in order to maintain the high quality of product demanded. The light factor was handled in the construction of the building with light locks and the use of special lighting, but the air conditioning was more difficult as the different manufacturing zones varied considerably in their requirements as to volume of air, temperatures, and relative humidities, which had to be maintained twenty-four hours a day regardless of outside weather conditions.

Air Conditioning

To properly condition the air, the portion of the plant used for manufacturing processes was divided into five zones, each zone having its own complete air conditioning system designed to meet its special requirements. For this work five Carrier units were installed. These units range in size from 2000 to 10,000 cfm. The cooling range extends from 75F down to 38F, the heating range from 38F up to 110F, and the humidification from 50% to saturation as required. The volume of incoming air for each zone is controlled by an outside thermostat economizer with outside and return air dampers and damper motors designed to operate when the dry bulb temperature outside is below the well water temperature. These outside air and return dampers operate through the dewpoint thermostat, modulating the amount of outside air taken for cooling purposes.

Controls

The controls inside the separate zones are so arranged that the room thermostat and hygrostat operate through a relay controlling the refrigeration machine until the outside air thermostat economizer permits the use of outside air, at which time the refrigeration machine is automatically cut out. The requirements governing the selection of the capacities of this air conditioning equipment were based on the assumption

†Chief Engineer, The Gevaert Company of America, Williamstown, Mass.

that the outside dry bulb temperature in summer would not exceed 90F coincident with an outside relative humidity of 50%; that the outside temperature in winter would not drop more than 10F below zero; and that the total occupancy of the conditioned spaces would not exceed those specified.

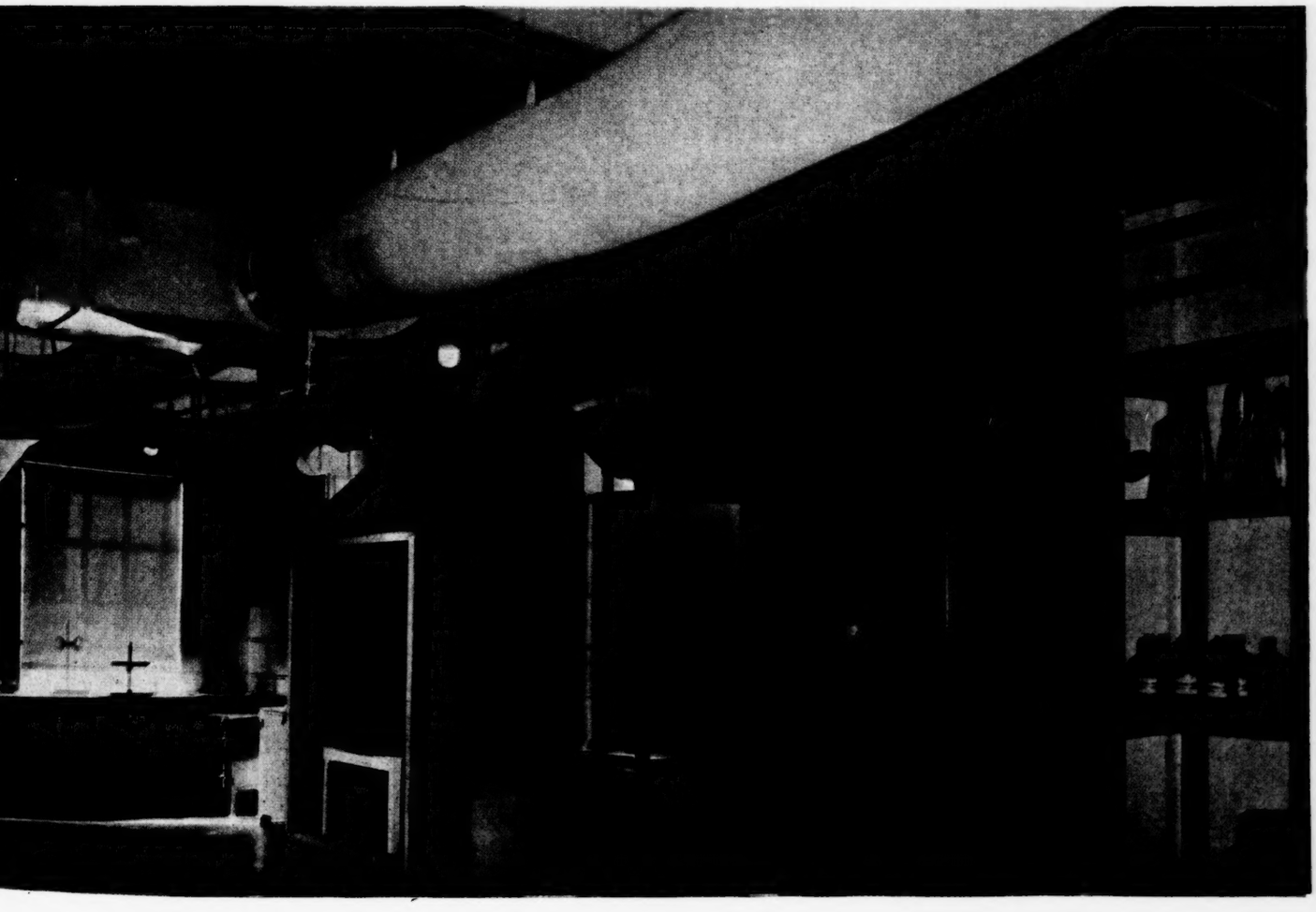
Well Water Supply

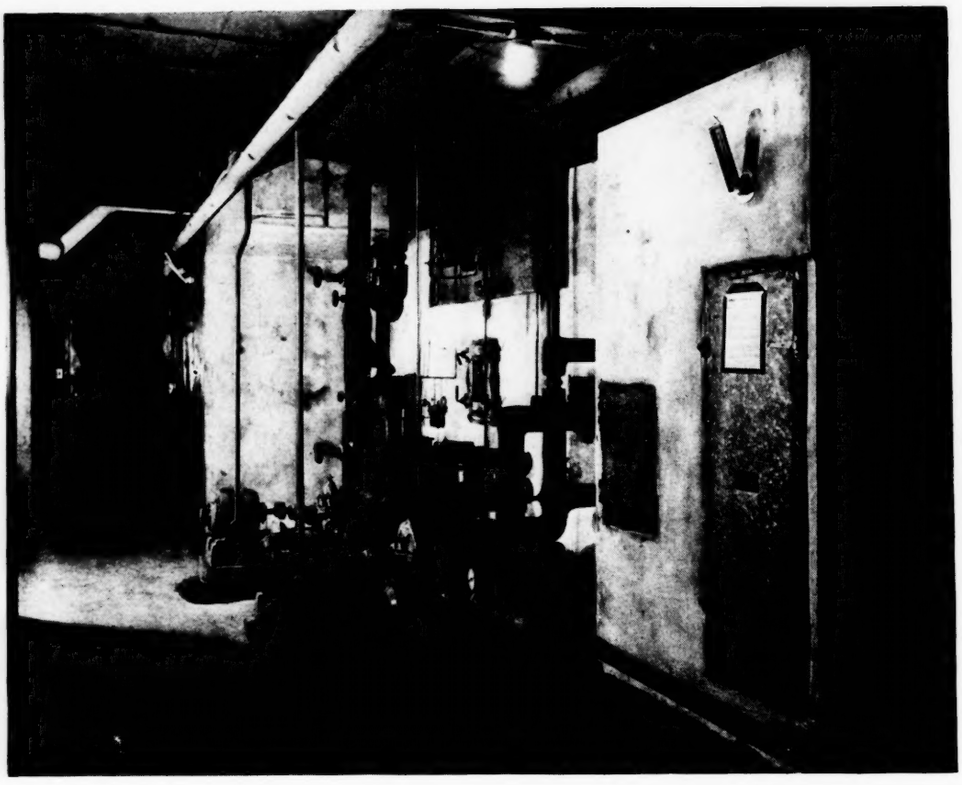
To supply the necessary amount of well water required for the air conditioning units and manufacturing processes, four wells, each about 200 ft deep, were drilled in the grounds adjoining the plant, and a flow of 200 gpm at 49F was secured. As the air conditioning units, under extreme summer conditions, require 141 gpm and the processing nearly as large an amount, a 50,000 gal storage reservoir was constructed in the sub-basement under the new laboratory building and the well water pumped to this reservoir where it was distributed to the plant as required. All water used for manufacturing is filtered and a considerable portion is distilled.

Ventilation

It is necessary that the numerous laboratories used for research and chemical preparations are thoroughly ventilated for the removal of fumes and that all incoming air is filtered to eliminate dust particles. The requirements for the different laboratories vary from six to twelve air changes an hour. This is accomplished by the use of Sturtevant ventilating units, vertical type, set high near the ceiling, which take fresh air directly through the outside walls in the desired quantities which vary from 2000 to 4000 cfm. The discharge air is exhausted from the laboratories by means of exhaust fans discharging through outside ducts over the roof. As the supply of fresh air through the units must be maintained at a constant number of cubic feet per minute when the rooms are in use, and as the different temperature requirements for the rooms vary from 40F up to 70F, the amount of steam supplied to each unit is controlled by a modulating steam valve on the supply to the unit, regulated by a thermostat. The warm air from each unit is blown through a main metal duct extending directly out into the room and then into cloth collapsible lateral ducts which are run out from each side of the main duct for nearly the whole length of the room. These cloth laterals are constructed of a special heavy canvas-like material with a thick wool-lined interior. They not only remove all dust from the incoming fresh air but

A view showing the canvas collapsible lateral ducts, lined with wool, which are removed and cleaned thoroughly once each week and then put back in place. They remove the dust from incoming air and also act as diffusers to distribute the supply air evenly.





View of pump and piping. Four wells supply water to a 50,000 gal reservoir from which water is drawn as needed.

act as diffusers and distribute the air evenly all over the room, eliminating all noticeable air movement. This condition is helped by the fact that 20% less air is exhausted from the room than is taken in, so that there is always a plus pressure. The cloth laterals are spaced for equal distribution and are sized to handle the required volume of air for the room, taking into consideration the entrance velocity of the air and the resistance of the cloth. The cloth ducts are replaced once a week, are cleaned thoroughly and then put back in place the following week. H. B. Smith direct cast iron radiators are installed in each laboratory to maintain a minimum of 50F when they are not being used.

Service Hot Water

The hot water requirements for the plant vary considerably in both the quantities and temperatures required. The equipment is designed to deliver the desired gallons per minute at a temperature variation of from 105F to 200F as required. Hot water for the toilets, showers, cafeteria, wash sinks, etc., is heated to one temperature and is supplied from a 500 gal, 300 lb test, black steel storage tank located in the boiler room. This water is heated by an indirect water heater with steam at 10 lb pressure. The amount of steam supplied to the coils of the indirect heater is governed by a modulating supply valve in the steam line which is controlled by a controller located in the storage tank. Hot water for laboratories and process work requiring different temperatures is supplied by tankless water heaters located directly in the process rooms themselves with steam supplied at 10 lb pressure, the steam supply remaining constant, and the water temperatures maintained by means of mixing valves on the outlets of the heaters.

Steam Distribution

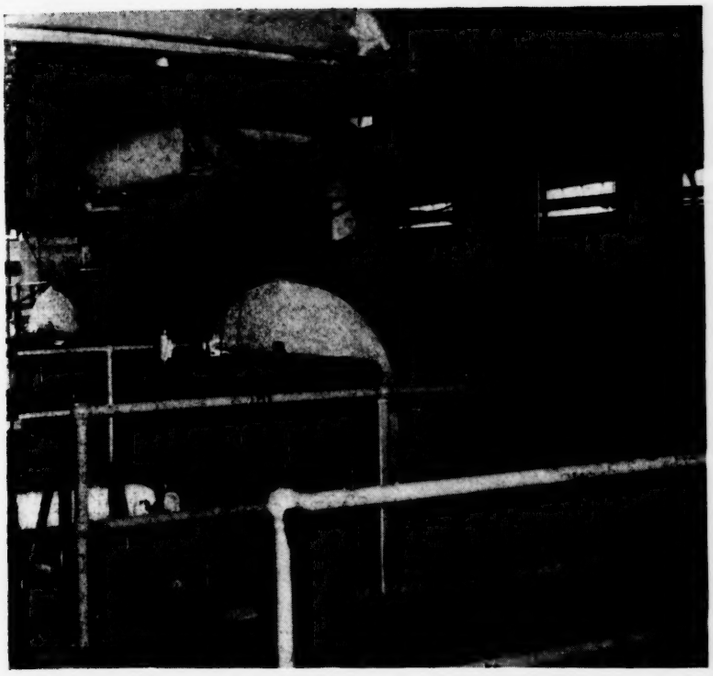
The distribution system for supplying steam to the different departments of the plant is therefore designed for the following types of use.

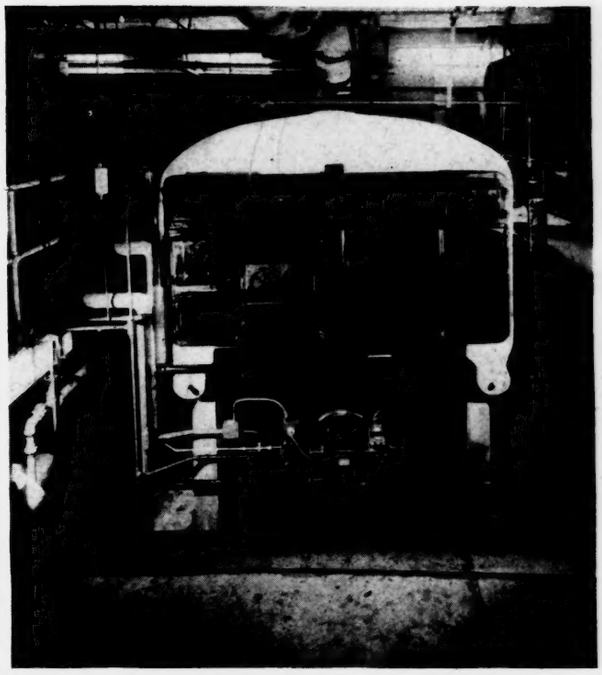
1. Direct radiation
2. Recirculating unit heaters
3. Air conditioning units
4. Ventilating units
5. Water distilling apparatus
6. Hot water supply
   a. Toilets, showers, etc.
   b. Process requirements.

The steam lines for these operations are controlled so that each system can operate independently, thereby eliminating unnecessary waste of steam.

Boiler Selection

The selection of the boiler plant involved a considerable amount of thought inasmuch as economy of operation was required when at night, holidays and week-ends, the boiler load dropped to about 40% of daytime operation. The same control and flexibility was desired of the boilers as was contained in the design of the steam distribution system. Boilers were required which would develop a high overall efficiency when fired with Bunker C oil, which would give a maximum length of service with no retubing or other maintenance costs, and which were constructed of a material that would not be eaten away by the acid formed by the sulphur contained in the heavy oils. Two No. 60 H. B. Smith cast-iron boilers were selected as meeting the above requirements and were installed with provisions in the piping system and





boiler room for the installation of a third boiler when contemplated additions are made. Each of these units has a gross rating of 20,400 sq ft capacity and has 823 sq ft of heating surface.

Oil Burners

The boilers are raised on a reinforced concrete base 36 in. high and are fired with Ray horizontal power burners with primary and secondary air intake dampers, burning Bunker C oil supplied from a 20,000 gal tank located in the ground just outside the boiler room. The oil is heated by below-the-water-line heaters located on the side of each boiler for steady operation, and with an electric oil heater in the line to each burner for cold starting. A hand switch, located in the boiler room, allows the burner to be operated on either pressure or thermostatic control. There is also a firing cycle control cut in the line to the thermostats that gives a ten-minute firing period out of every hour so that the oil does not solidify at any time.

Steam Heating System

The vacuum system of steam circulation for the plant is divided into three zones. A constant steam pressure of 10 lb is maintained for the process zone which supplies steam to the air conditioning units, ventilating units, all process work, and hot water supply. The other two zones are used for heating. One zone heats the offices and the other heats that portion of the plant not air conditioned or supplied with steam from the process zone. These zones are supplied with steam at 3 lb pressure and each zone is controlled by its own thermostat wired back to a modulating motorized valve which is located on the supply main in the boiler room and then through a relay back to the controls of the burners so that if the boilers are not being operated at a constant pressure either zone control will be able to start the burners.

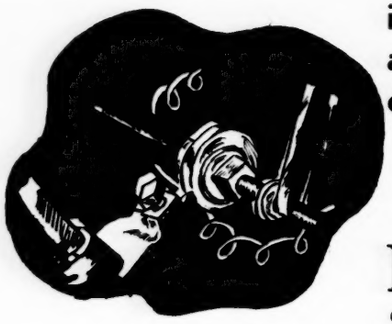
Condensate Return

Condensation from all heating, ventilating, air conditioning and process units as well as all main drips, is discharged to the non-pressure dry returns through Barnes & Jones traps. Float and thermostatic traps are used on everything except returns from radiators, which are dripped through thermostatic traps. The condensation from the system is returned to the boilers through a 40,000 sq ft Jennings duplex vapor turbine vacuum and boiler feed pump. This pump is operated on one side by an 8 in. vapor turbine valve installed in the 10 lb pressure main which is designed to operate the pump under a differential pressure of 2½ lb, while the other side of the pump is operated by a 3 hp electric motor. Due to the design of the piping the condensation returns to the receiving tank of the pump by gravity so that the pump is operated on float control except for the starting-up period in the morning.

Construction

When the installation cost of the plant was being figured the condensation load from all process equipment was known, but not the exact locations or the piping requirements, so that the entire contract was awarded on a cost plus basis to Walter J. Swiatek of Adams, Mass., who cooperated with the Gevaert engineers, J. J. Goovaerts and L. J. Stuckens, in working out the piping details. This manufacturing plant has been in operation for nearly a year now so that all equipment has been thoroughly tested and the results are very satisfactory, meeting all the requirements specified and required for the manufacture of such a high quality sensitized product.

Northern Pump Co.



increases efficiency of workmen by careful control of tempered air supplied by unit heaters 20 to 46 ft above floor. Thermostat directs graduate steam control valve and motor operation.

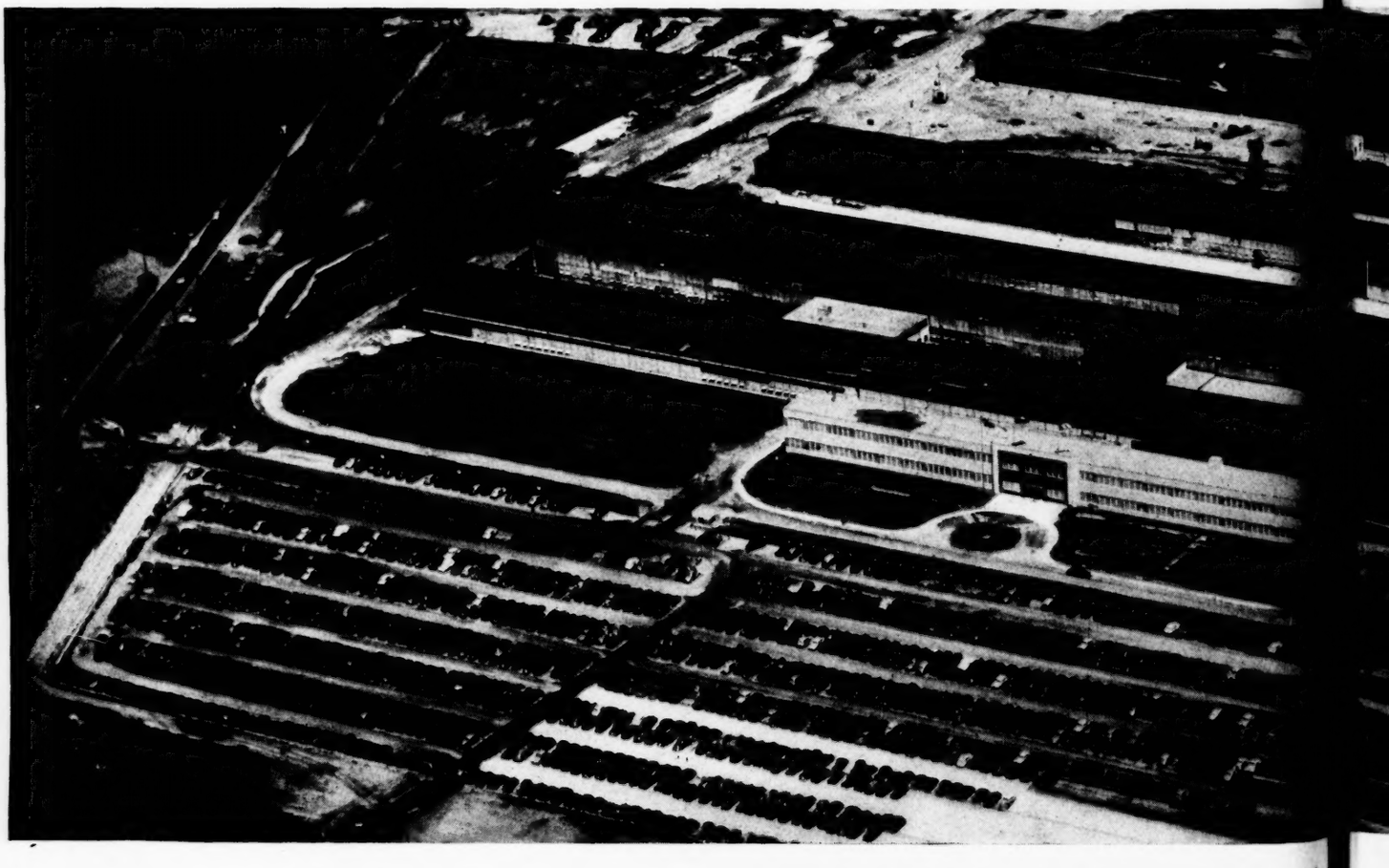
By J. E. HAINES†

NORTHERN Pump Co., awarded an "E" for efficiency by the Navy Department for which it is manufacturing equipment, has built a new plant at Fridley, Minn., consisting of several manufacturing buildings 1,200 ft in length and a two-story administration building approximately 420 ft long. These buildings were completed and manufacturing had started in less than four months from the time that the contractor started work on the foundation. Of special interest is the even distribution of heat from the unit heaters in the manufacturing buildings, which are of considerable height, in which the units are as much as 46 ft above the floor.

The interior view of a typical manufacturing building illustrates the location of these unit heaters which distribute tempered air equally throughout the buildings. These units are of the vertical delivery type, which take in air through the four sides of the unit and deliver the air downward through distributing vanes. The units in the center of the plant are 46 ft above the floor and those in the other sections of the plant are 32, 22, and 20 ft above the floor. Steam is fed to these units at five pounds pressure.

These units operate under the direction of pneumatic controls which provide for the delivery of tempered air to the factory space. A graduate thermostat operates (1) a pressure control which shuts off the unit heater fans when no heat is required for each group of two or more unit heaters and (2) a graduate steam control valve in the steam supply line to each unit. With this simple system of control, air is delivered from the unit heaters at exactly the right temperature to offset the heat losses from each individual section of the building, and the unit heater fans run all of the time so long as any heat is required. Each of the steam control valves is equipped with an iron body valve because of the unusual strain due to the movement of the long steam mains.

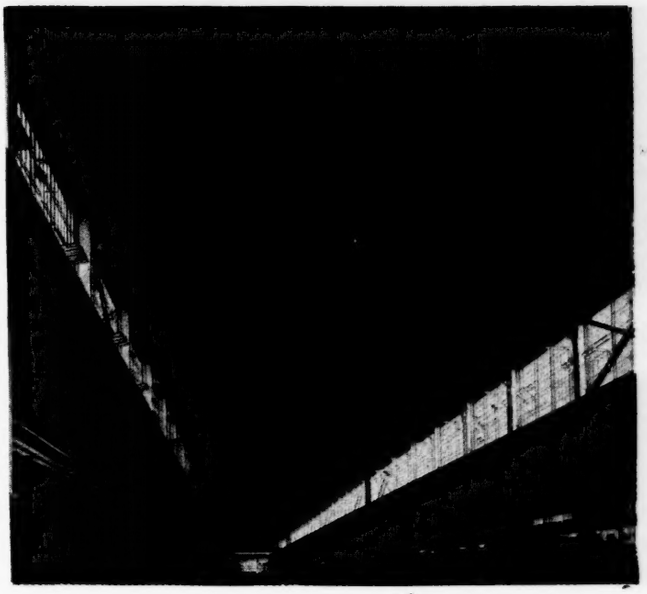
†Manager, Air Conditioning Controls Division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

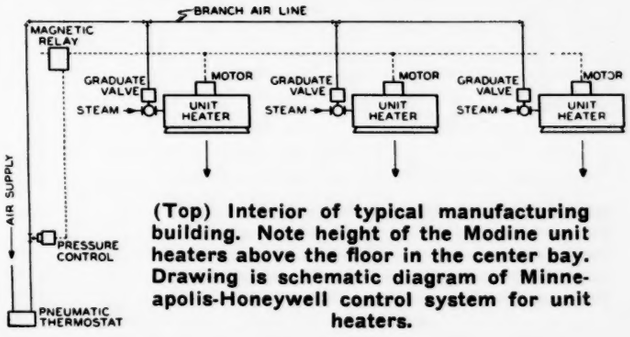


Continuous operation of the unit heater fans and the delivery of tempered air during the heating period eliminates the blasting of hot air and the stratification of air which often results from the control of unit heaters by "on-off" thermostats. This constant delivery of tempered air provides for more comfortable working conditions for the workmen in the plant, and it is believed that their efficiency is increased considerably.

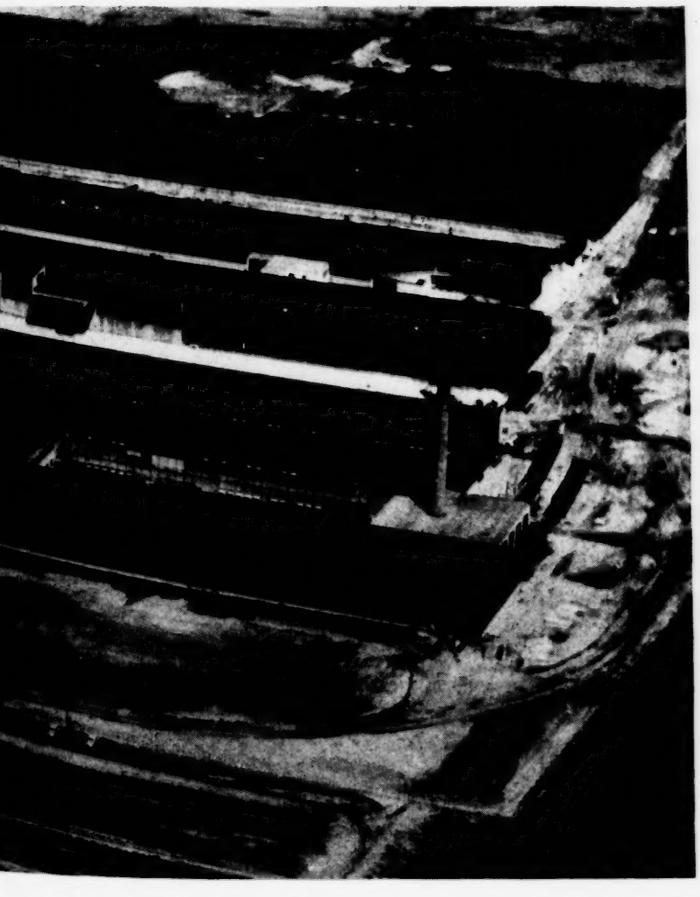
The drawing shows a typical control system for the units. The thermostat controls the steam valves so as to graduate the amount of steam fed to each unit. When the steam valves are closed by the thermostat, the branch line air pressure is increased to the point where it trips the pressure control, which, in turn, shuts off the unit fans. When heating is required again, the thermostat reduces the branch line air pressure, the pressure control starts the fans, and the valves throttle the proper amount of steam to each unit heater coil.

On some installations of this type it has been found desirable to add an "off-on-automatic" manual switch so that the unit heater fan may be turned off manually or operated continuously during summer to provide for air movement in the plant. Another pressure controller may also be used to measure the steam pressure in the steam line to the unit and shut off the unit fan whenever there is no steam pressure. Through the use of this second pressure control, all of the unit fans may be stopped if the steam to the main is cut off during the night. This more complete control system may be either electric or pneumatic. This feature was unnecessary at the Northern Pump Company plant because it is being operated twenty-four hours per day.





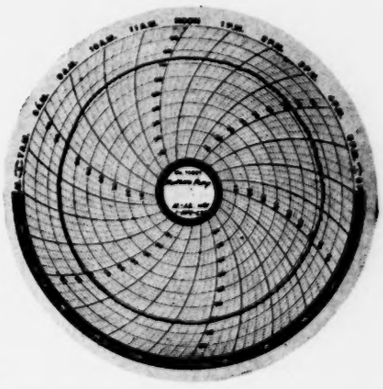
(Top) Interior of typical manufacturing building. Note height of the Modine unit heaters above the floor in the center bay. Drawing is schematic diagram of Minneapolis-Honeywell control system for unit heaters.



The temperature chart indicates the accuracy with which the temperature is maintained in the Northern Pump plant in spite of the height of the unit heaters.

The Administration Building is heated by convector type steam radiators and is ventilated and humidified by an air conditioning system in winter. During the summer the air conditioning system cools and dehumidifies the air for this building.

The architects were Pesek & Shifflet, the consulting engineer was A. D. Martino, and the heating contractor was the Belden-Porter Company, all of Minneapolis.



(Left) Plant of the Northern Pump Co., Fridley, Minn. Manufacturing buildings are heated by automatically-controlled unit heaters. Chart adjacent shows even temperature maintained.

Plant of Charles Pfizer Company which has nine spaces air conditioned by systems installed from 1916 to 1941.

Charles Pfizer Company,

Brooklyn chemical manufacturer, has used air conditioning since 1916, and added systems from time to time and as recently as 1941. One of the newest systems maintains specific temperatures and humidities in chemical storage space, operates economically and eliminates effects of weather.

By L. J. WACHS† and W. H. WETHERELL†

THE importance of air conditioning in research, manufacturing, and storage of chemicals was realized by Charles Pfizer Company as early as 1916. From the first installation of air conditioning equipment which supplied 10,000 cfm to a testing room, the system has grown so that now more than 40,000 cfm of air are conditioned for specific rooms throughout the plant buildings.

The Charles Pfizer Company itself has grown from one small plant in 1849 to more than thirty-five buildings today, not including New York and Chicago offices and the Chicago warehouse. The newest buildings, a warehouse and a four-story office structure housing offices, engineering department, laboratories and library, include air conditioning for many of the rooms.

The growth of air conditioning for the Charles Pfizer Company is shown in Table 1. All of the early equipment is still in use. The 1940 installation has already proved its value and within a short time the 1941 installation will be in complete operation to eliminate effects of outdoor weather in many of the rooms in the newest of the buildings.

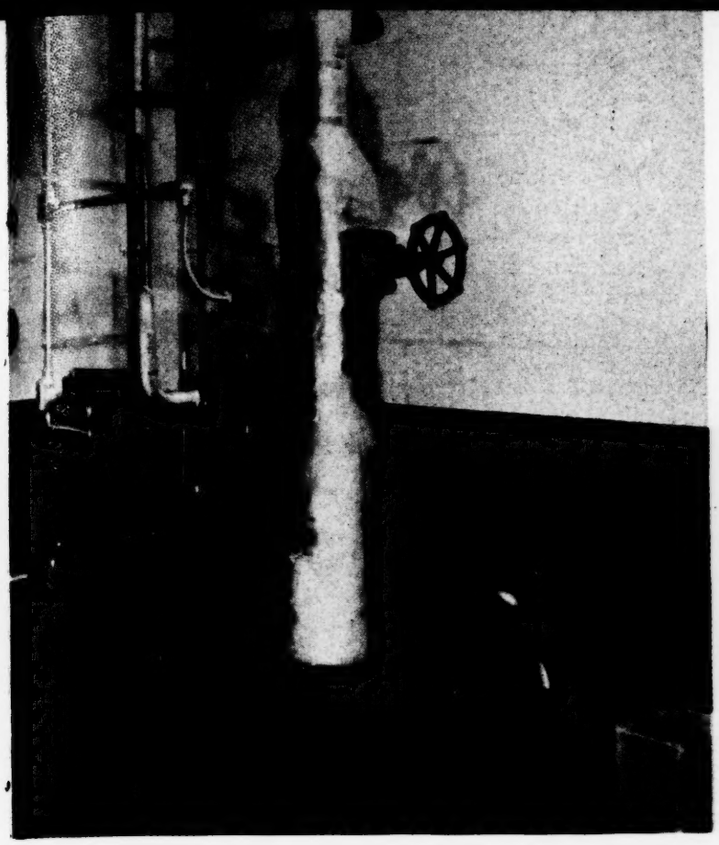
The most recent installations are not only the most modern, but their applications are of special interest. For this reason, the description of the air conditioning equipment is limited to the new systems.

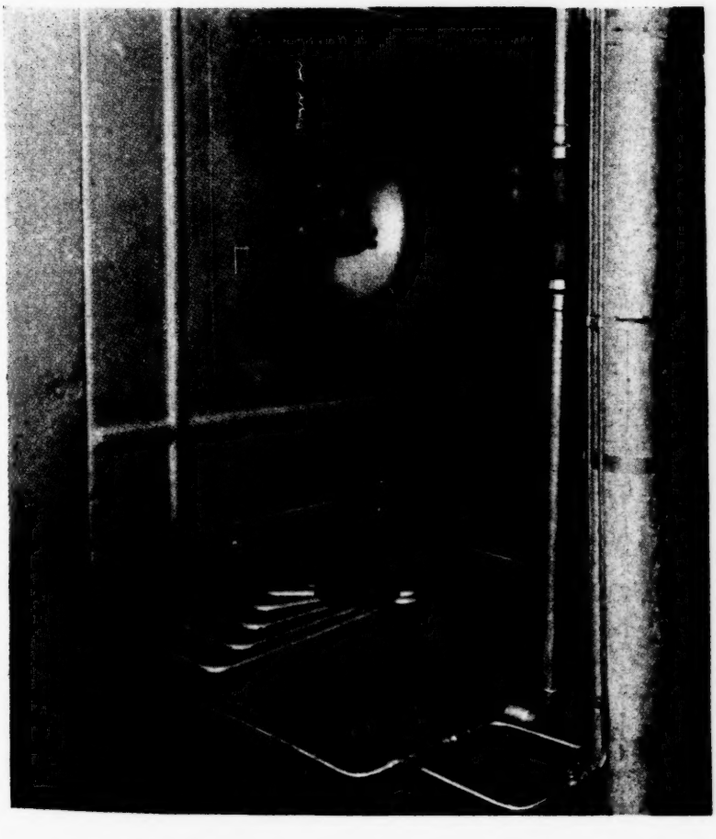
Storage of Chemicals

Air conditioning is required for rooms in which chemicals are stored to prevent changes in air temperature and relative humidity that would cause the product to change while being held for shipment. The air conditioning system to serve the storage floor is not only designed to provide and maintain specific temperature and relative humidity for chemical storage, but it is so flexible in operation that any temperature from 70F to 80F and a relative humidity not greater than 45 to 55% can be maintained according to the specific requirements of the chemical stored. The range of conditions meets the needs of the wide variety of chemicals stored in barrels or bags on the floor at various times.

The storage is approximately 225 ft long and 100 ft

†Carrier Corporation, Syracuse, N. Y.





wide. The building is of typical heavy reinforced concrete construction with brick outside walls. The floor which is air conditioned has a small lighting load to keep heat gain from the lights at a minimum. Windows were omitted to reduce the heating and cooling loads. The walls, floor, and ceiling are not insulated as the heavy construction keeps the heat transfer low.

At a midpoint of the long wall of the 3rd floor storage space one bay has been enclosed to house the major air conditioning equipment. In this apparatus room is located one air handling unit, one refrigerating compressor, one evaporative condenser, and related equipment, as motors, switches and other accessories. Located on the opposite long wall, also at a midway point is one air handling unit. It is not enclosed in a room, but is located within the air conditioned space.

Both of the air handling units include fans, cooling and heating coils, drip pan, motors and accessories for controlling temperature, relative humidity and motion of air. Air intake connections to the outdoors permit a maximum 100% of the air to be drawn in from the outside. Located at the intake of each unit is a return grille which permits recirculations of room air, reconditioning it before distribution to the room. Each air handling unit handles one-half of the conditioned air supplied to the room.

The discharge duct from each unit divides into two branches, each branch running from the midpoint location of the apparatus to the end of the room. Each unit, with its two branches of ducts, thereby supplies conditioned air to a half of the space, the division being lengthwise of the building.

Outlets are located on both sides of the ducts, with one outlet to each bay. That portion of the air which is discharged towards the center of the space, provides constant conditions for the center bays as well as for those nearer the ducts.

Return ducts are not required as the central location of the units permits the use of return grilles only for returning the air to the apparatus.

The refrigerating equipment, necessary for cooling and dehumidifying the air during warm humid days, consists of a 50 hp Carrier Freon reciprocating compressor, evaporative condenser, and all accessories necessary for economic and automatic operation of the plant. The cooling and dehumidifying coils in both air conditioning units are supplied with the direct expansion refrigerant from the one refrigerating machine, interconnected with copper refrigerant piping.

The air circulated over the wetted coils of the evaporative condenser is drawn from the air conditioned space, so that the fan in the condenser serves a double purpose—(1) supplying the air for evaporative condensing and (2) furnishing an exhaust system for the room, making it unnecessary to install a separate fan for exhaust.

Controls

The control for maintaining the desired temperature and relative humidity con-

TABLE 1.—AIR CONDITIONING INSTALLED BY CHARLES PFIZER CO.

System	Year Installed	Capacities CFM	Space Served
1—Full Housed Centrifugal Fan 1—Well Water Dehumidifying Washer Duct Heaters	1916	10,000	Cooling Crystallizers
1—Full Housed Centrifugal Fan 1—Humidifying Type Washer Automatic Dew Point Control Ducts Heaters	1919	2,350	1 Crystallizing Room
Changes to divide room to 2 rooms. Extra heater controls	1921		The above Crystallizing room made into two rooms
1—Dehumidifying Washer 2—Carrier Special Cold Diffusers 1—Reciprocating Freon Condenser 1—Evaporative Condenser 39—Double Diffuser Type Outlets	1940	10,000 20,000	New Warehouse—3rd Floor—225' x 100'
4—Carrier Self-Contained Weathermakers complete with Fans, Coils and Freon Condensing Units	1941	14,000	*Area in 4-Story Laboratory Bldg.* Executive offices—2nd Fl. Engineering Dept.—2nd Fl. Account. Dept.—2nd Fl. Laboratories—3rd Fl. Library—3rd Fl.

sists of a Johnson Service pneumatic thermostat and humidistat located within the conditioned space. Either instrument can increase the amount of refrigeration to prevent a rise of temperature or a rise in relative humidity. A drop in temperature throttles the air volume to prevent over-cooling. A further drop causes the thermostat to open a valve permitting steam to enter the reheating coils. Bristol recorders, one for registering the temperature, one the relative humidity, provide a permanent record of the conditions of air maintained.

When refrigeration is not called for, that is, when outside air conditions are favorable as measured by a Comfostat, the outside air dampers gradually open and the return air dampers close. If outside conditions are not favorable for cooling, then the outside air damper remains closed and the control instrument gradually opens modulating expansion valves at the cooling coils. The refrigeration machine is controlled by refrigerant suction pressurestats. A Hubbell cylinder bypass on two of the four cylinders is provided, so that either one-half or full capacity is used as required.

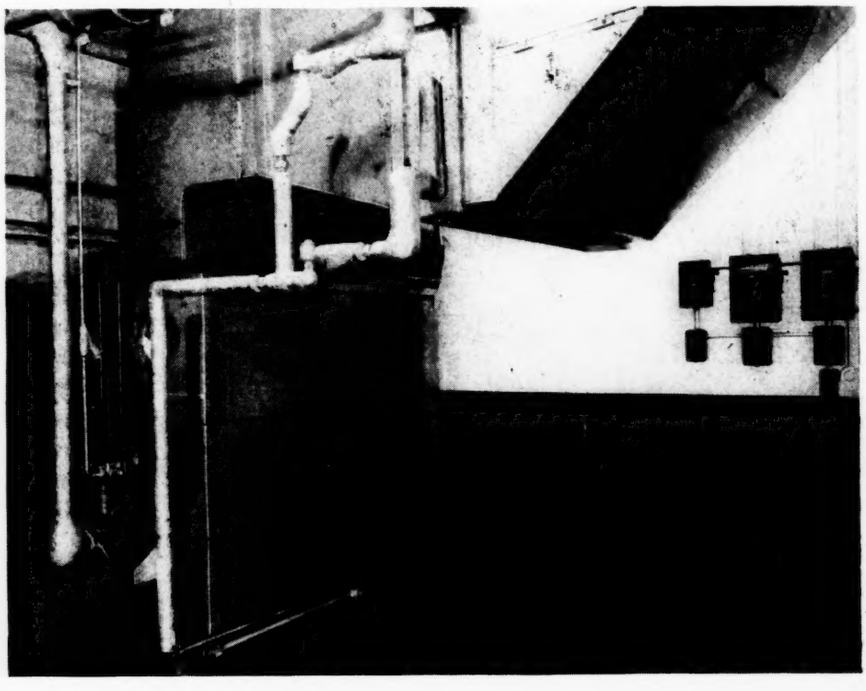
Wiring is so arranged that no air is passed to the control system until at least one of the air conditioning fans is operating. The evaporative condenser cannot operate unless one unit is running and the compressor cannot run unless the evaporative condenser is operating.

The entire system provides not only the desired conditions of air for chemical storage, but is adaptable for maintaining a variety of conditions to suit different chemicals. The system is simple and efficient. Economy in operation is one of its outstanding features.

Four Story Building

The variety of rooms in the new four story building requiring air conditioning made the selection of four self-contained air conditioning units advisable. Each unit includes the air handling apparatus and the refrigerating equipment in one housing. Ducts are used for distributing the air to the spaces to be conditioned. The units, their location, and the spaces each serve are shown in the table on the next page.

Each unit includes fans, filters, heating and cooling coils, Freon condensing unit and all accessories, factory assembled for complete control of air as required. The Unit A has, in addition to the above, a humidifying element to provide a close control of the moisture content in the air supplied to the laboratory.



The Carrier air conditioning unit which serves the chemical storage space and is connected to the refrigeration compressor illustrated previously.

Unit	Location	Space Served
A	3rd App. Room	Laboratory on 3rd Floor
B	3rd App. Room	Library on 3rd Floor
C	2nd Floor	Accounting Dept. on 2nd Floor
D	2nd Floor	Engineering Dept. Conference Room and Executive Offices on 2nd Foor.

The main control for each unit is a thermostat which starts and stops the refrigeration machine or admits steam to the main heating coil as required. The Laboratory system also has a humidistat in parallel with its thermostat.

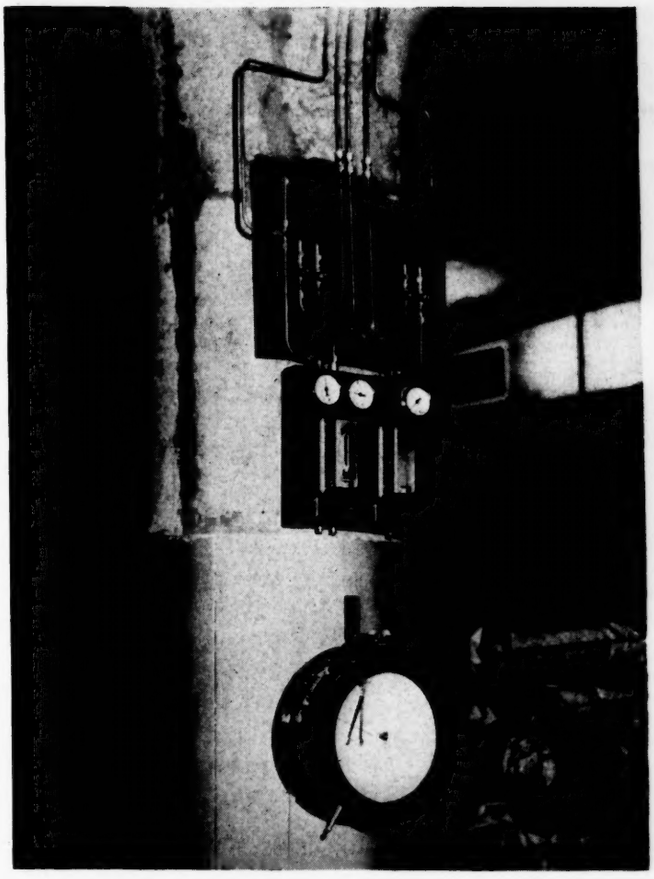
In addition rooms are grouped into subzones of similar exposure and each subzone has its own thermostat and reheat coil. Certain executive offices and the conference room are also set up as subzones, the conference room being also equipped with manual control to cut it off entirely when not in use.

All radiators throughout the conditioned spaces are tied in with the automatic control system.

The ducts distributing the conditioned air from the units to the rooms and the return ducts are run at the ceiling and concealed by being furred in. The air outlets are of the ceiling type.

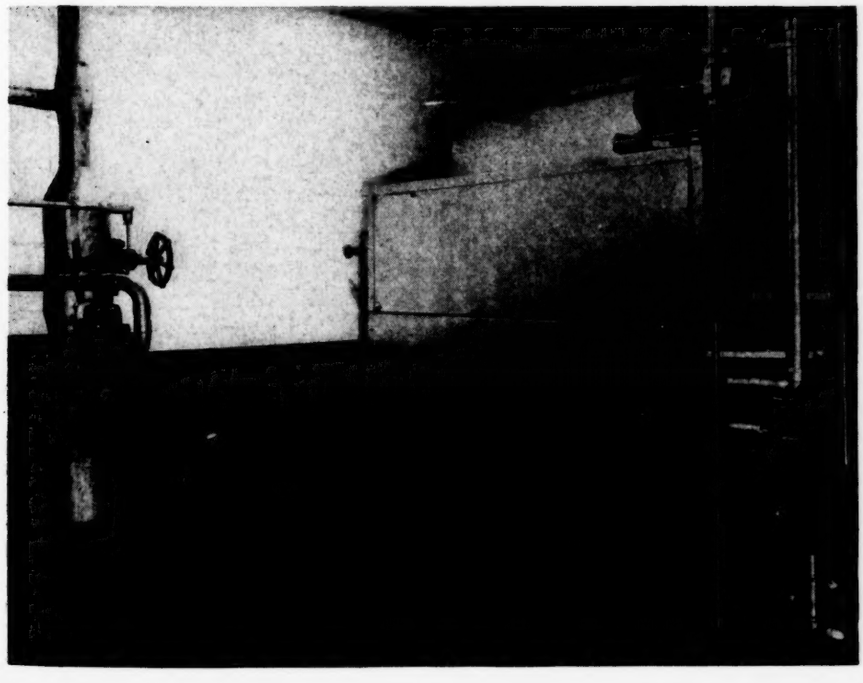
Well water used in supplying the cooling on the early installations is also available for condensing purposes and is used in the water-cooled condensers of each of the four self-contained air conditioning units. The supply was not sufficient to serve directly as a cooling medium for the newest systems that are cooling and dehumidifying the air.

The control of temperature, relative humidity, and circulation of air which is cleaned, provides the indoor weather that is most conducive to high efficiency and accuracy. The constant conditions of air in the laboratory permit controlled research. Books and papers will not deteriorate as they would do if not protected against unfavorable weather with air conditioning.

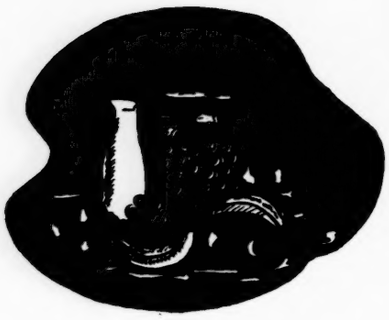


Control station showing the Johnson Service controls which supervise temperature and humidity in the air conditioned storage floor. Below is the Bristol temperature and humidity recorder.

The Charles Pfizer Company, with the newest installations, has extended the applications of air conditioning in chemical manufacturing. Beginning with chemical processing and extended to storage, research, engineering department, offices and library, a large variety of uses of air conditioning are now included in the systems at the plant of this manufacturing chemist.



The evaporative condenser, part of the air conditioning system for the chemical storage space.



Food Concentrates

installs a dehumidifying and conditioning unit for maintaining 24% relative humidity in its grinding and packing room to insure dehydrated foods of uniform texture and quality. Installation by Mance Air Conditioning Corp.

By ARTHUR G. HARMS†

THE highly specialized industry which manufactures concentrated foodstuffs has recently assumed a new importance due both to the needs of the National Defense Program and to the technical improvements in manufacturing. While the industry in this country is many years old it is only recently that many products such as bananas, tomatoes and molasses have been successfully concentrated in commercial quantities.

Dehydrated and powdered foods are produced for a variety of reasons. In some cases the foods are dehydrated to make it possible to store them for considerable periods without refrigeration. In other cases the concentration makes it possible to ship the food economically over long distances because of the savings in space, while in some instances powdered foods are better adapted to the manufacture of semi-prepared foods such as ready mixed biscuits and cakes.

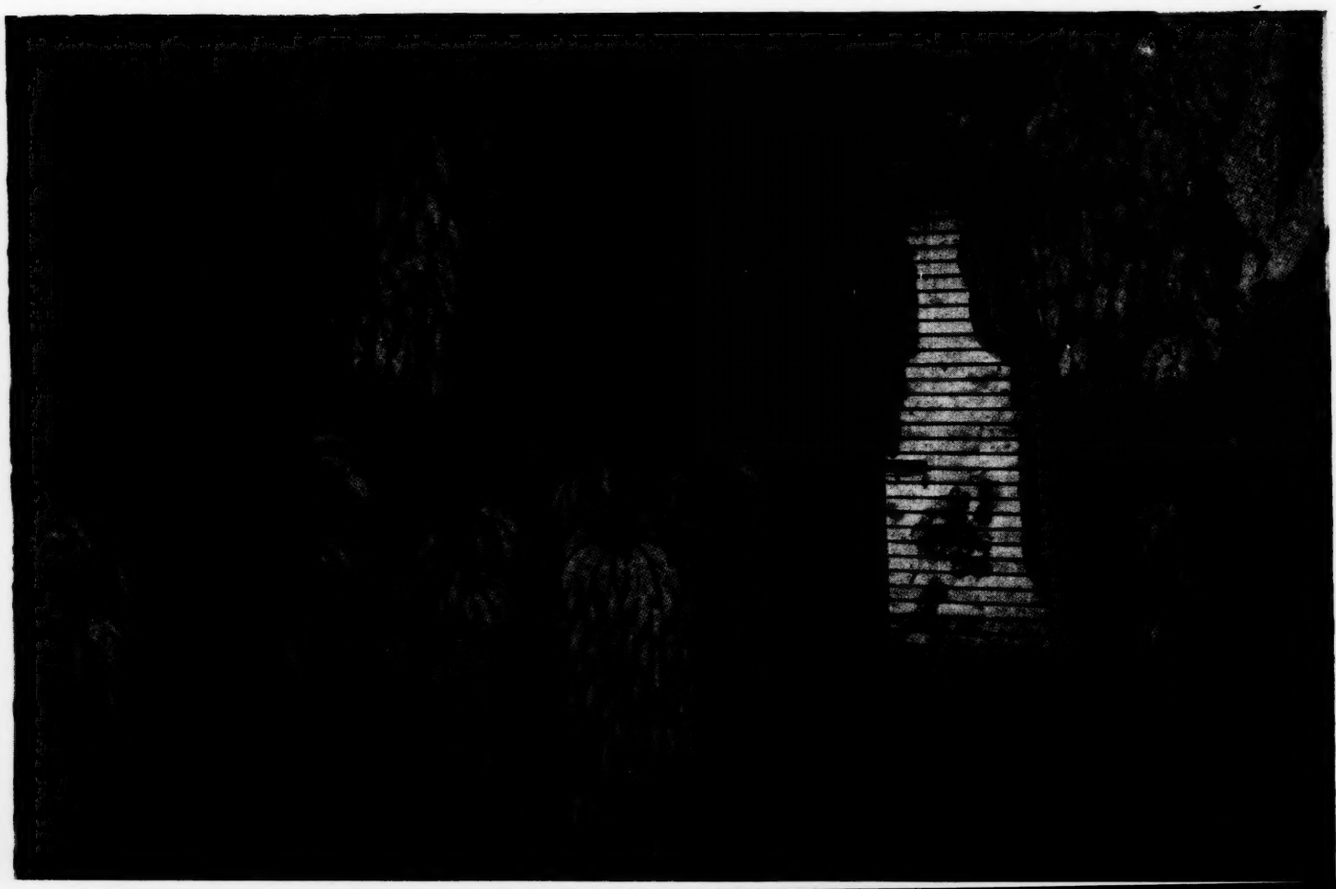
Food Concentrates, Inc., Woodbridge, N. J., a subsidiary of United Fruit Company, is at the present time producing dehydrated and powdered food products such as molasses, bananas and cocoanuts. These foods in a concentrated form are extremely hygroscopic and can not be handled above certain temperatures and humidities. Therefore it is necessary to use air conditioning during their manufacture.

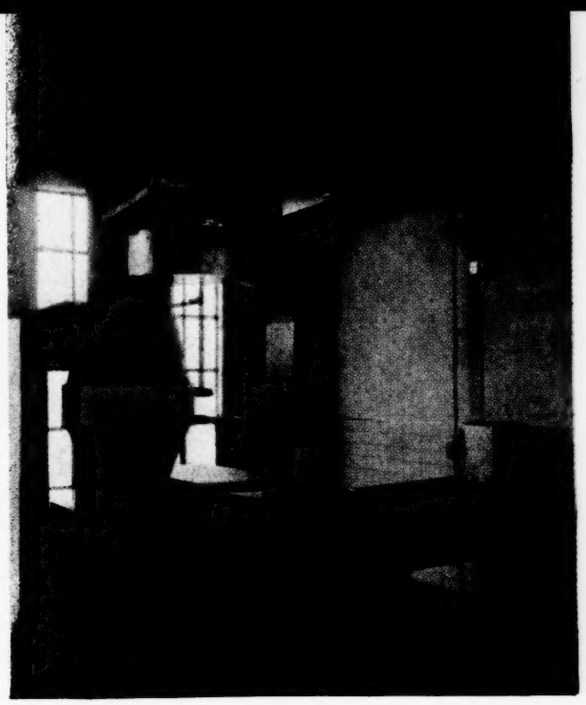
In general the foods are dehydrated by applying heat in the proper amount and temperature. After the products are dehydrated they must be cooled to a working temperature before they can be further processed. In the case of the products handled by this company the cooling must be done in a room where the relative humidity is maintained below 28% otherwise the food products absorb moisture and become very sticky.

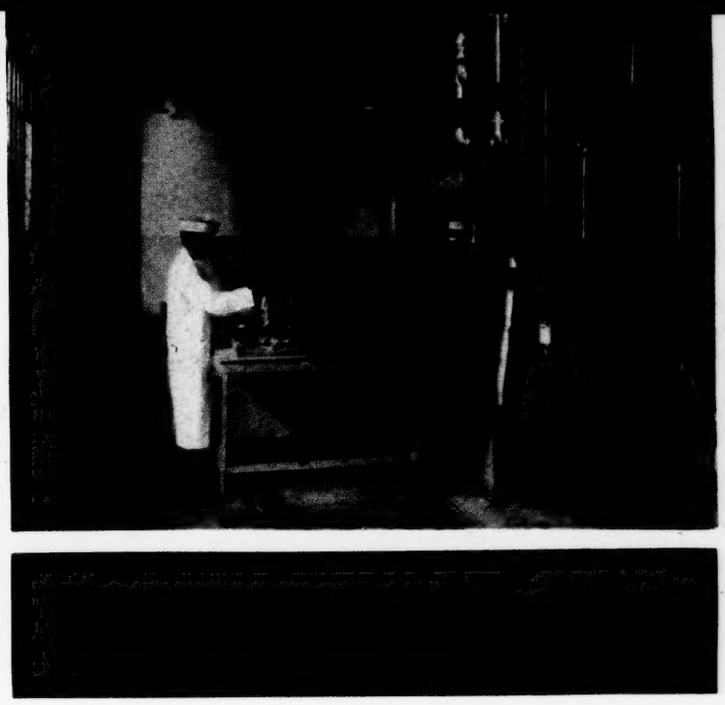
After dehydration all of the subsequent processes such as milling or grinding, sifting, sorting and packing, must be done in a room where the conditions are maintained below 28% relative humidity and a dry bulb temperature of below 85F. It is important to maintain the relative humidity below 28% since these food products are extremely hygroscopic after they are put into powdered form and exposure to a higher

†Engineer, Mance Air Conditioning Corp., New York, N. Y.

Section of one of the banana ripening rooms where the bananas are carefully ripened before being dehydrated. At the rear of the room can be seen a York water type cooling unit which maintains the proper temperature in the room.







humidity for any length of time will cause spoilage of the entire batch. The dry bulb temperature must be maintained below 85F since above this temperature the powdered product will pack and gum up so that it can not be handled.

When Food Concentrates, Inc., erected a new plant at Woodbridge early in 1941 they carefully considered all methods for maintaining the desired conditions 24 hours a day every day of the year. The system selected as the most satisfactory installation to maintain an independent control of temperature and humidity was a combination of well water for cooling and a Bryant silica gel dehumidifier for dehumidification. A special room was constructed for handling the dehydrated food products. The room is 14 ft wide, 30 ft long and 12 ft high. All of the walls and the ceiling were insulated and the inner surfaces were furnished with sheet metal so as to prevent moisture infiltration and to make it possible to clean and wash the room of any dust particles released by the grinding operation. A double door air lock was installed to prevent excessive entrance of moisture when the materials were brought in and out since the manufacturing processes cause the surrounding space to have a high humidity.

Sensible Load

The sensible heat load to be removed by the well water included the wall and ceiling conduction; the heat released by three to four workers; about 800 watts of light; 14 hp in motors; plus the heat from 800 cfm of air passing through the gel bed where the latent heat is transferred to sensible. Thus, the total sensible internal load was approximately 34,000 Btu per hour.

Latent Load

The latent load included the moisture given off by three to four workers; moisture infiltration; and the moisture in 100 cfm of makeup air. This load totaled about 13,700 Btu per hour. The design conditions were selected as 95F dry bulb and 80F wet bulb outside; the inside conditions as 85F dry bulb and 24% relative humidity.

Well water at a temperature of 55F supplies the necessary cooling while a Bryant rotary type dehumidifier takes care of removing the moisture. This unit has a capacity of 800 cfm which consists of 100 cfm of outside air and 700 cfm of recirculated air. Under design conditions the mixed air enters the dehumidifier unit at 54 grains of moisture per lb of dry air and 86.9F dry bulb, while it leaves the unit at 127F dry bulb and 20 grains of moisture per lb.

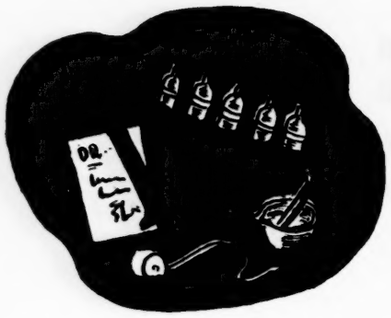
Well water at a temperature of 55F is supplied to two coils which cool the hot dehumidified air from 127F to 85F and approximately eight gallons per minute are used. After the water leaves the second cooling coil it is discharged outside the building and used to water the lawn.

The system is automatically controlled by a humidistat which starts the operation of the Bryant silica gel unit and a modulating type thermostat in the return duct which operates a modulating type water valve in the well water supply. The gas supply is regulated by a diaphragm valve and its position is automatically set by the moisture content of the air entering the gel bed.

The dust released by the grinding and sifting operations makes air cleaning a problem. This has been solved by installing 3-in. washable filters in the return air duct with a preliminary cloth filter installed before the final washable filter. This preliminary filter is accessible from inside the room and makes it possible for the operators to brush off the larger powder particles as they accumulate during the manufacturing operations. The washable filters are usually cleaned once a day.

The system has been in continuous operation for 6000 hours and has proved satisfactory in every detail. As a result of this installation Food Concentrates, Inc., can manufacture and ship their product throughout the entire year. Needless to say by this method of accurately holding the humidity and dry bulb temperature at the most favorable conditions the final product is always of a uniform texture and quality.

Sharp & Dohme, Inc.,



proves that air conditioning is indispensable in handling hygroscopic pharmaceuticals. Four portions of Philadelphia plant are conditioned to enable full production rates to be carried on regardless of the outside weather fluctuations.

SHARP & Dohme, Inc., is an internationally known manufacturer of pharmaceuticals and biologicals. Its main plant is located in Philadelphia where it occupies a seven-story building on Broad Street. While the majority of the company's products is better known to professional groups than to laymen, some of them have received such wide spread recognition that the names are nationally familiar. Among these are ST-37, an antiseptic hexyl-resorcinol; BJ-1, an antiseptic powder; Alkolav, a rubbing alcohol; Lyovac, a human blood plasma, and, perhaps best known of all—Sucrets, throat lozenges.

Air Conditioning

Air conditioning has proved itself indispensable in four portions of the company's main plant. One system is used to serve three of these areas: a capsule filling room; a department where pills are coated; and, third, an area where tablets are compressed. The fourth area, with its own air conditioning system, is that where Sucrets are packaged.

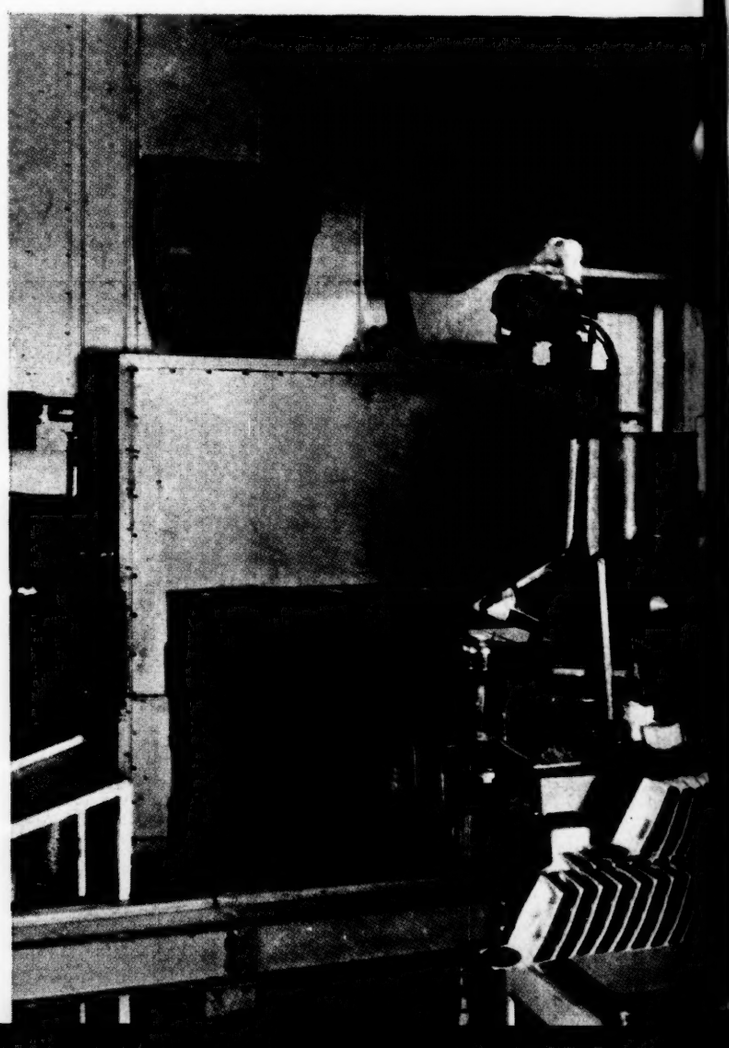
Pills, Tablets and Capsules

The tablet, pill and capsule handling departments are located in an area totaling 6860 sq ft and a volume of 85,000 cu ft. Although the processes are all quite different the problem, generally speaking, is the same. In connection with capsule filling, the powders with which the capsules are filled are hygroscopic and on warm humid days the powder absorbs moisture to a point where it is difficult to handle and does not flow smoothly through the machines. This situation has been remedied with air conditioning and there is no production problem now regardless of the outside weather.

Since there is also a ventilation problem in this department, exhaust ventilation is provided to draw off the excess air-borne powder at the automatic machines so that it does not spread through the atmosphere.

Pills are coated and polished in another department in large rotating metal barrels, or pans, which, when partially filled with the uncoated pills, are rapidly revolved. From time to time during rotation the pills are sprayed with a candy coating in liquid form. As the pills revolve they pick up the coating uniformly, so that the coating process is one of building up. As the liquid coating dries, moisture is released to the surrounding air, and this tends to increase the undesirability of the natural atmosphere in the summer; to add to this there is considerable heat given off by the machines themselves as well as by the process. The tablet compressing space presents a similar problem to that in the capsule-filling room in that the powder from which the tables are formed is hygroscopic. When moist, the powder balls up, will not compress properly and a condition called capping (breaking of the top of the pill) results.

The condition maintained in all of these spaces by



Sharp & Dohme is well known for its Sucrets—antiseptic throat lozenges. This view shows a corner of the packaging room with the automatic machinery for wrapping and packing. The Sucrets enter this room from the manufacturing room adjacent at 120F and it is necessary to cool these and also to remove the moisture so that they are dry before packaging; otherwise it would be necessary to store them for a considerable period and even then they would be sticky in humid weather. The 15-ton Frick unit air conditioner shown makes it possible to carry on this process during the summer months.

Tablet compressing room in the Sharp & Dohme plant. In this room air conditioning has eliminated what was formerly a very undesirable condition, particularly in the summer when the powder from which the tablets are compressed would absorb moisture. The result was that in the summer the powder would be lumpy and the compressing machines would be clogged. Production now flows smoothly.

the Ross conditioning system is 85F wet bulb and 35% relative humidity. The total load in the three departments consists of approximately 35 people, 34 kw of electric heaters, 5 kw of lights, and 86 hp in motors, together with the removal of heat and moisture from the outside air to bring it to the desired conditions. Design conditions in Philadelphia are usually set at 95F dry bulb and 78F wet bulb.

In order to condition the air both dehumidifying and cooling are resorted to. The cooling is accomplished by two 15 hp Universal and one 15 hp Curtis condensing units while the dehumidifying is provided by a Pittsburgh Lectrodryer unit. The latter takes outside air and furnishes to the coating pans 210 lb per min of air to from 105 to 155 dry bulb and with a maximum dewpoint of 51F. The air from these pans is drawn off by an exhaust system and rejected to the outside, so that dehumidifying is not provided for the other areas.

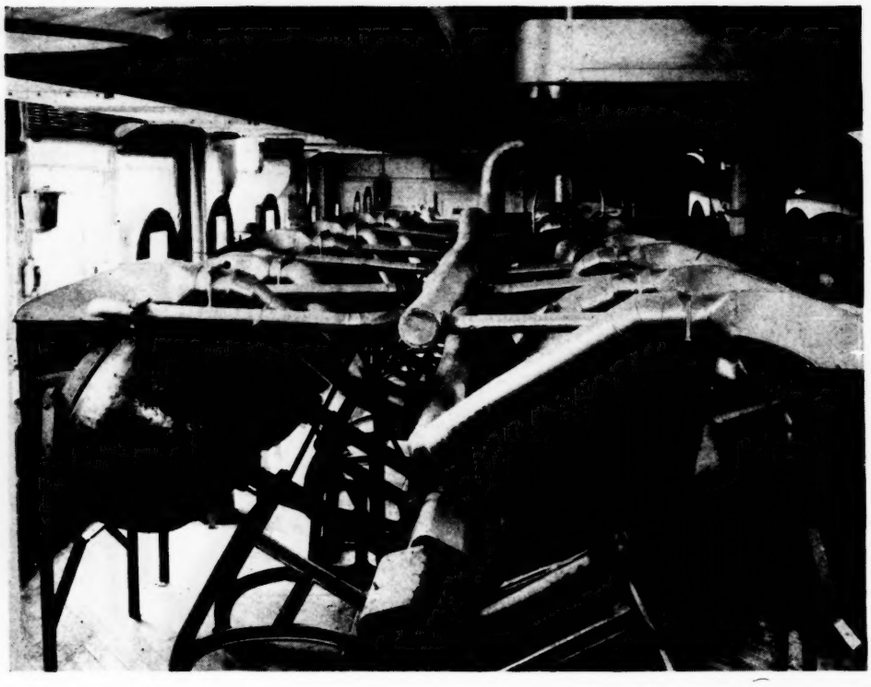
Heating and cooling surfaces in this system are of spirally-finned copper tubes. Renewable filters are used and these must be frequently cleaned due to the rapidity with which they become clogged with powder.

Control

The system is under the control of a dry bulb thermostat which regulates the steam admitted to the reheaters. A wet bulb thermostat regulates the refrigerating plant so as not to allow the humidity to exceed the maximum desired; another dry bulb thermostat regulates the water flow to the cooling coils to maintain the supply air to the coating pans at the predetermined temperature. Approximately one-third of the total air furnished by the cooling system is recirculated, and the remaining 1500 cu ft per minute is brought in from the outside.

Sucrets Manufacture

Six hundred pounds of Sucrets are manufactured per hour in a room adjacent to that where these lozenges are packed. The lozenges are brought into the packing room on a continuous conveyor at 120F. Since the lozenges are quite sticky at this temperature it is necessary to cool these the year round to 80F dry bulb; a relative humidity of 40% at this temperature has been found to be satisfactory. If either the dry bulb temperature or the relative humidity is higher

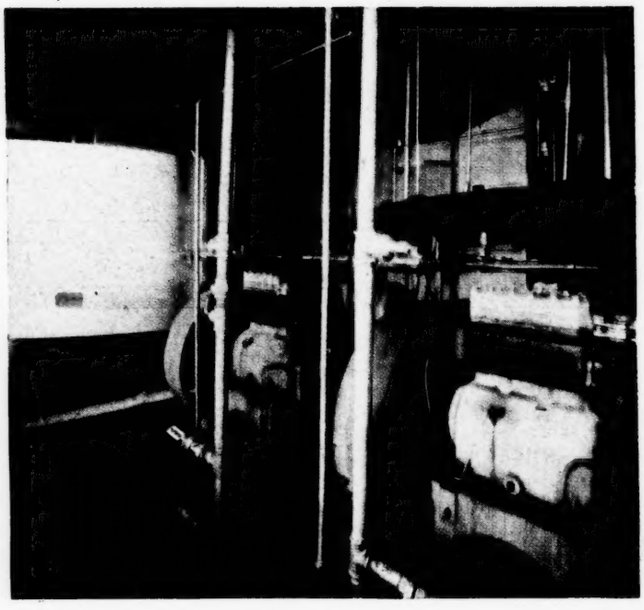


The pill and tablet coating room in which the air is maintained at 85F dry bulb and 35% relative humidity by equipment located in a machinery room. The conditioned air is supplied to this space through the Anemostat. The uncoated pills and tablets are placed in the cooking pans and revolved at a fairly high rate of speed while candy coating is sprayed into the mass at intervals. This process gives off heat and also moisture as the coating dries. Consequently, air is supplied to these coating pans with a very low moisture content from a Lectrodryer located in the machinery room through the upper duct extending down beneath the rows of pans. As this air picks up moisture from the process it is exhausted through the duct system located below the supply ducts, as shown, and rejected to the outside.

than these figures, the sugar in the lozenges becomes sticky to a point where the automatic packaging machine will clog. By cooling the air to the conditions mentioned, however, high speed production in packaging has been attained, and, in addition, a more nicely packed product has resulted.

To accomplish this cooling a self-contained Frick industrial air conditioning unit has been provided with two rows of steam coils and six rows of cooling coils. The 16-ton compressor cools the brine, in at 38 and out at about 44F. This takes care of the whole packaging room, approximately 60 x 40 x 14 ft, served by 4250 cfm of air. Of this, 740 cfm is fresh air.

Modern air conditioning thus enables Sharp & Dohme to fill gelatin capsules independent of outside weather and in a clean atmosphere with pleasant working conditions; to compress tablets without capping or spoilage of a large percentage; to operate coating pans at a high production rate even in moist weather when evaporation would normally be so low as to slow down the operation, and yet to maintain comfortable working conditions; and to allow the packing of lozenges with a minimum of delay between manufacturing and wrapping.



Another view in the machinery room in the Sharp & Dohme plant showing the Universal condensing units and, at the left, the Pittsburgh Lectrodryer unit which dehumidifies the air supplied to the pill coating pans.

Catalin Corporation

uses adsorbers to remove odors from air in plastics plant, to eliminate chlorine and other gaseous impurities from air.

The Catalin Corp., one of the major producers of plastics, has installed a large Dorex adsorber to purify the air supply for its new plant at Fords, N. J., to remove chlorine and other gaseous impurities from the atmosphere. Chlorine is a serious foe to plastics manufacture, causing undesirable chemical reactions even when present in small quantities. Investigation by the Catalin Corp. revealed that the air surrounding the site of the new plant was subject to a fairly high contamination by nearby manufacturing processes.

The adsorber removes all obnoxious gases and acids from the atmosphere. Canisters containing highly activated specially processed carbon extract the undesirable gaseous impurities in the atmosphere. The functioning of the adsorbers is akin to gigantic gas masks.

Owens-Corning Fiberglas Corp.

applies industrial humidifiers to maintain 65% relative humidity in its Ashton plant to prevent too rapid drying of lubricant in glass filament manufacture, uses ventilation to carry off process heat from electric furnaces.

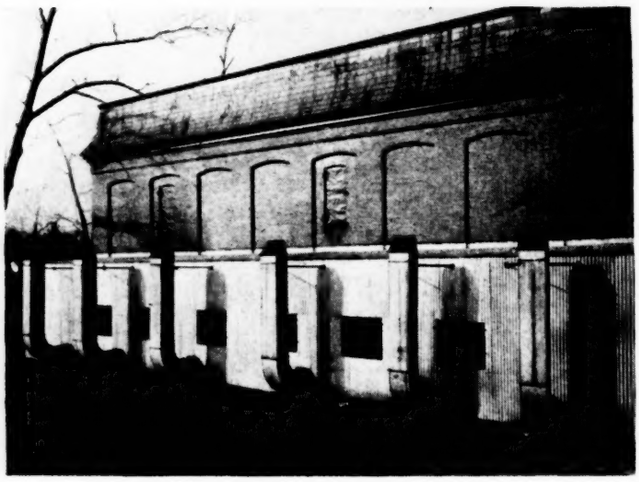
A MATERIAL which is playing an increasingly important part in America's war efforts is an extremely fine glass fiber known as Fiberglas. This material, a comparatively recent development, has rapidly increasing demands for civilian uses and is now being found of considerable help in this country's greatly increasing war efforts.

The present application of these glass fibers can be divided into four major classifications: industrial service fabrics, textiles, thermal insulation and air filters. The fabrics have widely varied uses including electrical insulation, fireproof and wrinkle proof fabrics, chemical filters, and Army and Navy applications. The glass fibers in the form of a refined mineral wool are also used for heat insulation in boilers, stoves, refrigerators, pipes, motor vehicles and railroad cars, Navy and Maritime Commission vessels, and buildings. In another form they become storage battery retainer mats, and a fourth very important use is as a filtering medium in Dust-Stop air filters.

The manufacturing of the glass fibers should be of interest to heating and ventilating engineers not only because it involves a rather unusual industrial process but also because the process used in fabric production requires the maintenance of relative high humidities.

The Ashton, Rhode Island, plant of the Owens-Corning Fiberglas Corporation specializes in the manufacture of both continuous and staple fibers for making glass fabrics. The continuous fiber might be com-

Winder room in continuous fiber manufacturing section. Ventilation air enters through openings in the floor underneath winders and passes up through the winder room to mezzanine above where the electric furnaces are located. Automatically controlled humidifying nozzles on this floor maintain a 65% relative humidity.



Steam and air are discharged through these outlets from the staple fiber producing machines. About 42,000 cfm of the mixture is removed.

pared to either silk or rayon in that it is a continuous filament. The staple fiber is like wool or cotton in that the threads are formed from hundreds of individual fibers drafted and twisted to form a yarn. Both materials are produced both in the form of yarns and wound strands which are then handled almost like silk or wool. The products produced are used for electrical insulation, for fabrics, for Naval uses and for chemical filters. They have the advantage over other textile materials in that they are not affected by humidity or even by relatively high temperatures.

Continuous Fiber Manufacture

The continuous fiber glass strands are produced by melting glass marbles about 5/8 in. in diameter in an electric furnace. At the bottom of the melting chamber is an orifice plate with 204 orifices through which the melted glass flows. The melting chamber is kept at the temperature required to make the glass about as fluid as honey. The filaments produced are so fine that one 5/8 in. marble will produce 98 miles of a single continuous filament. The diameter of the filaments is controlled by the temperature of the molten glass and by the speed at which the filaments are drawn.

The 204 filaments produced are passed through a spray of a special lubricant and are then passed through a metal V-shaped notch which draws the fibers into a single strand. The special lubricant serves two purposes: to lubricate the filaments, and to act as a temporary binder to make the filaments adhere to each other in subsequent fabricating operations. The single strand which is formed is then drawn down to a high speed winder. These strands are so fine that at least two strands are twisted together to form a thread suitable for weaving.

It is interesting to note that while the temperature of the glass in the melting chamber is within the 2000F to 3000F range, it is cooled to about 110F by the time it reaches the V-shaped notch about 4 ft below the furnace and is further cooled to about room temperature by the time it reaches the winding machines about 15 ft below.

The next step in the continuous filament process is to twist and combine the strands to form a yarn and to wind the yarn on cones ready for shipping. For some applications the individual strands are wound side by side on tubes to form multiple end strand. The yarn is supplied to wire and cable manufacturers or sent to mills for fabrication into cloths, tapes, braids, or cord.

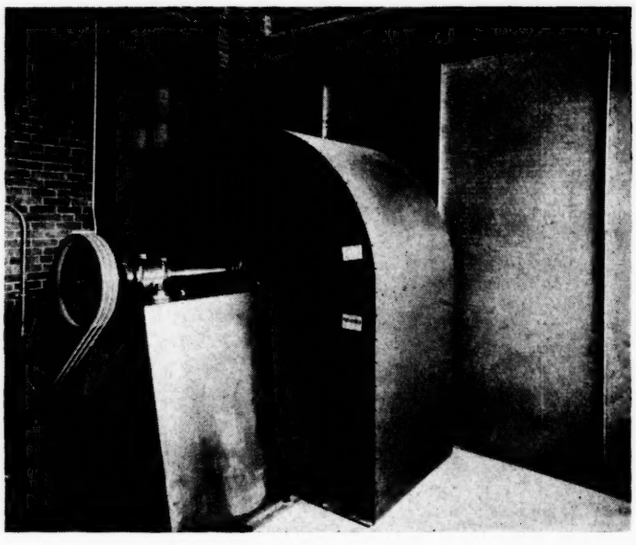
Air Conditions

In the room where the continuous filaments are produced it is necessary to maintain a relative humidity of 65% to prevent the special binding and lubricating liquid from drying too rapidly. It is also necessary to pass large amounts of air through this room to remove the heat given off by the electric furnaces.

This room was formerly part of a three story factory section. In modernizing the plant to produce glass fiber the second and third floors were removed and a mezzanine was placed about 10 ft above the first floor. On this mezzanine were placed the electric furnaces which are used for melting the glass. Above the mezzanine is a large open space in which is located a large duct for recirculating the air. The roof of the room is equipped with a number of roof ventilators which serve to remove the excess heat.

On the first floor of this room are located the winders which take the strands produced by the furnaces on the mezzanine and wind it on cones. Openings in the mezzanine floor are provided so that the strands can reach the winders on the first floor. A low basement beneath the first floor is used as a pipe chamber, a plenum chamber for the ventilation air and to house the necessary mechanical equipment such as pumps and motors.

Each of the furnaces gives off approximately 5 kw or a total of about 2,050,000 Btu is released per hour. It is desirable both from the standpoint of the process and for comfort of the workmen to maintain a temperature of 85F on the electric furnace mezzanine and



Fan and air heating chamber for supplying ventilation air to the continuous fiber room. This air is discharged into a low basement beneath the first floor which is used as a plenum chamber.

a temperature of about 75F and 65% relative humidity on the winding floor.

Even in the coldest weather the problem in this room is not to provide heat but to supply enough outside air to remove the excess heat from the electric furnaces. The heat loss of this room is about 800,000 Btu per hr in 0F weather with a 15 mile per hour wind while the heat produced from the furnace amounts to about 2,050,000 Btu per hr. Thus, even in zero weather it is necessary to remove 1,250,000 Btu per hr. At the present time this is done by bringing about 25,000 cfm of 60F air into the basement and allowing it to pass through openings in the first floor underneath the winding machine. This air is filtered by passing it through Dust-Stop filters located in the openings. The desirable humidity is, at the present time, maintained by American Moistening Company humidifying nozzles located about 7 ft above the floor in the winding room. These are automatically controlled by a humidistat.

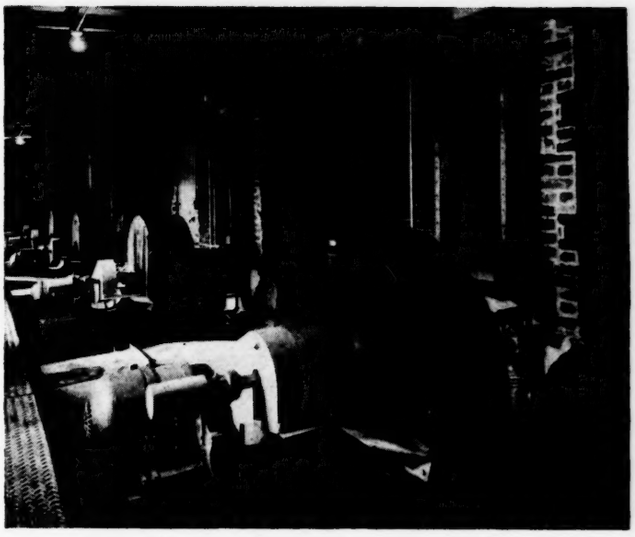
It is expected, however, when the plant is in full operation and during extremely cold weather it will be necessary also to place humidifying nozzles in the basement to make it possible to force enough water into the air to maintain the necessary 65% relative humidity.

Under most conditions the temperature on the furnace floor is maintained at about 85F. A portion of warm air is withdrawn from the ceiling of the building and is passed back to a conditioning room located just outside the building. The excess air is passed out through roof ventilators.

The recirculated air is mixed with the necessary amount of outside air and is then passed through a bank of Dust-Stop filters and then over two Aerofin steam heated coils. These coils are installed so that in case the plant is shut down it will be possible to maintain temperatures above freezing in the plant.

American Blower 25,000 cfm capacity fans take the mixed air and force it through the filters and heating coil. Space has been provided in the fan room for an additional 25,000 cfm fan which will be installed to help supply the large amounts of air needed for ventilation during the summer.

Coning room where the continuous filaments are twisted and combined to form a yarn and are wound on cones. Relative humidity in this room is maintained at 65% by humidifying nozzles shown above the machines.



Five of the large planing mill exhaust fans which are used for exhausting the mixture of steam and air from the staple fiber machine. This air is discharged out of doors as shown in photograph on page 82.

Staple Fiber Manufacturing

The staple fiber is produced in a similar type of electric furnace as the continuous fiber but the process differs in that the individual filaments on leaving the orifice plate are drawn at high speed by the alternating action of high pressure steam. This blast of steam throws the individual filaments from the orifices down to a large rotating, perforated drum. However, before the filaments reach the cylinder they are sprayed with a binder and passed through a large gas flame which serves to dry the binder. The filaments strike the rotating perforated drum at such a high speed that they cannot be seen and form a fine web on the surface. This web is immediately gathered up and wound at high speed on a cone in the form of a sliver. This untwisted strand or sliver is then drafted and twisted much like cotton or wool to form a yarn.

In this process it is not necessary to control the relative humidity in the room since the filaments are surrounded by a jet of steam and therefore the atmospheric humidity does not affect them.

To prevent the steam from the nozzles from getting into the room and to help deposit the glass filaments on the rotating drum, several hundred cubic feet per minute are withdrawn from each drum. The mixture of steam and air is carried by ducts to large planing mill exhaust fans which then discharge it out of doors.

These staple fiber machines require removal of about 42,000 cfm of steam and air. Therefore, this much air must be brought into the room and heated to about 75F. The electric furnaces each release about 6 kw or 240,000 Btu per hour, which helps meet some of the heat requirements. The other heat is supplied by Nesbitt steam coils located in openings in the walls and roof. As the air is drawn through these openings it is heated by the extended surface steam coils.

Somerville Packing Company,

large independent kosher packing house near Boston, uses refrigeration for beef chilling, hog cooling, sales cooler and lard roll; unit heaters are provided for slaughter rooms, with condensate return system.

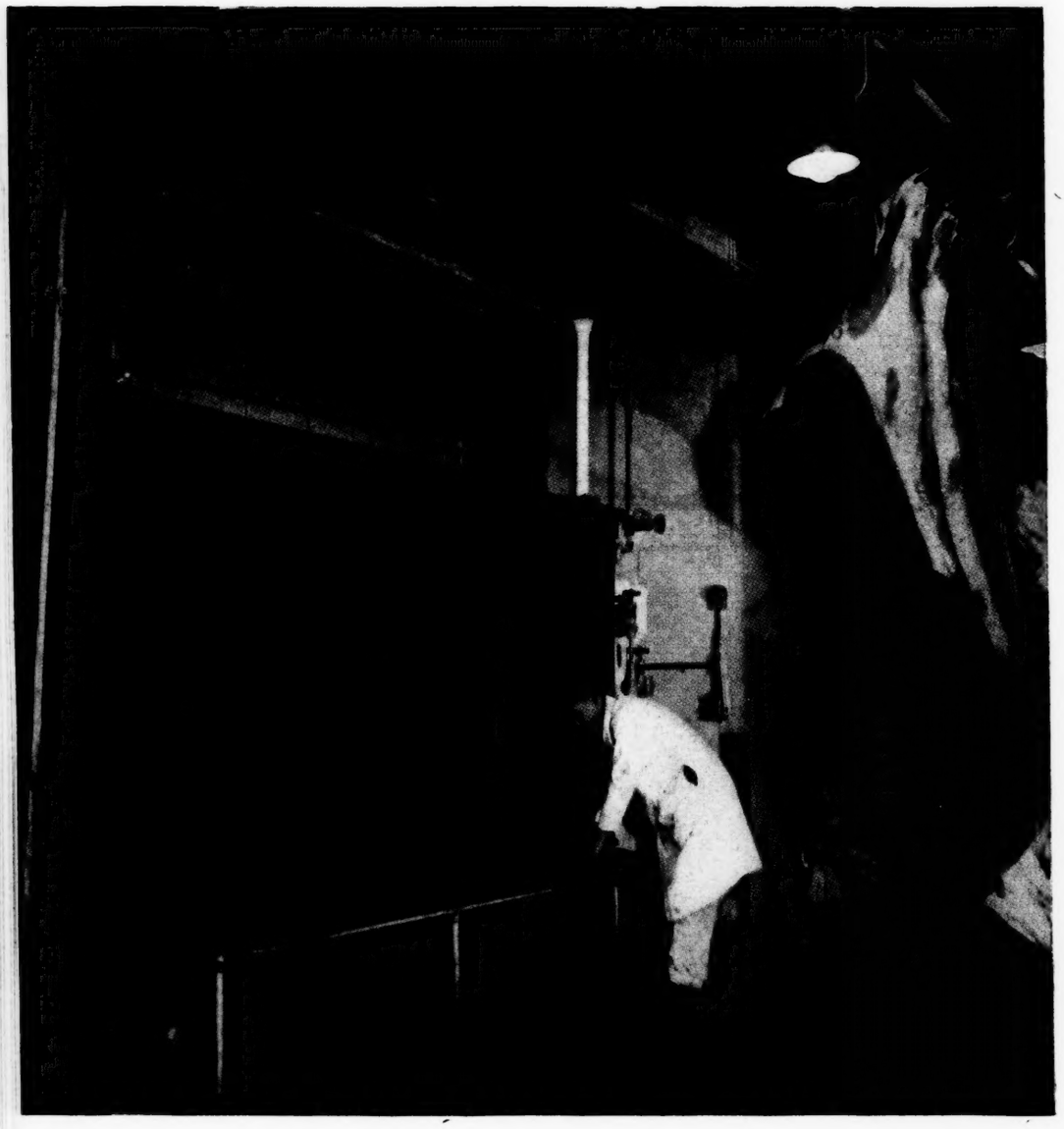
A MODERN meat packing plant and abattoir requires for successful operation not only heat, hot water and steam power, but also ample ventilation and a huge amount of refrigeration and air conditioning. So equipped is the Somerville Packing Company, Somerville, Mass., said to be the largest and most modern independent kosher packing plant in the country.

This plant is not a packing plant in the ordinary sense, since the activity is one of the slaughtering and preparation for market of beef and pork, with no processing work performed. The capacity of the plant is 1000 cattle a month and 2000 hogs a week, the company shipping beef, veal and pork daily to large customers. Processing of products, such as hams, bacon, shoulders, etc., is done at a subsidiary plant in Boston, operated under the name of the Northeast Packing Company.

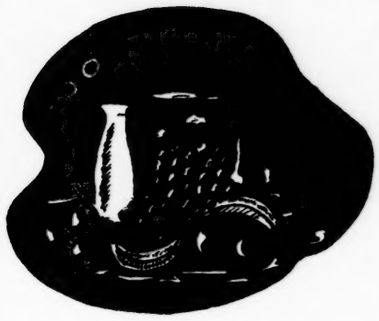
The building is two stories of steel frame and brick construction. It is 94 ft deep x 204 ft long, with concrete and tile floors, easily washed down, and a concrete ramp for stock driven into the building. A basement contains the boiler room and heating equipment, together with the York refrigeration and air conditioning equipment, a portion of the basement being set aside for dumping hides and hair from the upper floor slaughtering rooms.

The plant is one of the cleanest, lightest and airiest plants of its kind to be found. Large high, steel frame windows admit fresh air at all times, providing enough so that there is no need of additional intakes for the air conditioning, which, instead, recirculates interior air. Spaces air conditioned include the offices, accounting department, social room, lunch room, inspectors' rooms, and dressing rooms.

Heating equipment includes a Titusville Scotch type boiler from the Titusville Iron Works Company, 17 Trane convectors located under windows and 14 Trane unit heaters, eight of them suspended and six of the ceiling type. The heating system is of the Shaub steam vapor type, and there are also medium pressure lines for the sterilizers. Other heating equipment used includes a Bird-Archer blow-off muffler and an Auto-Shaub boiler feed system—a 5-hp unit of 30 gpm capacity. Piping is of steel. The boiler is fired by an S. T. Johnson full automatic oil burner.



A York blast cooler in the storage room of the Somerville Packing plant.



Originally there was 75 hp of refrigeration in a specially designed York ammonia system. This has since been increased somewhat. The refrigeration also takes care of summer air conditioning and is sufficient to provide in winter all the cooling required. There is no tie-in with the heating system.

Refrigeration equipment includes four York compressors and an evaporative condenser on the roof to handle 18,000 cfm of air. This condenser has a splash proof motor and low head circulator, to handle 100 gal of water per hour.

An economizer of 59 tons rated capacity provides for the water entering at 75F wet bulb and condensing pressure at 185 lb per sq in. Evaporative temperature averages 15F, for the horizontal air discharge. There is also a non-condensing gas purger.

Layout of the plant consists of the slaughtering and cleaning rooms, beef chill room, hog cooler, sales cooler, freezer, lard roll, offices and social rooms, all on the upper floors. The greater part of the ground floor is given over to shipping facilities.

The beef chill room has an air cooling unit with short ducts, and handles 100 cattle averaging, dressed, 600 lb each, with an average temperature of 33F. Temperature of the beef carcass is lowered from around 100F to 33F in approximately twenty hours.

In the hog cooler is another air cooling unit with short ducts, opening out at various points. It is capable of handling 200 hogs of 170 lb average weight, cooled down to the average of 33F in twelve hours.

As the meat gradually works toward ultimate sale, refrigerating temperature is kept constant. The sales cooler can handle 100 carcasses of cattle averaging in weight 550 lb from 40F down to 33F, with relative humidity kept at 87%. The freezer is used to take care of offal and has a capacity of 1500 lb at one time, cooling it from 40F to 10F.

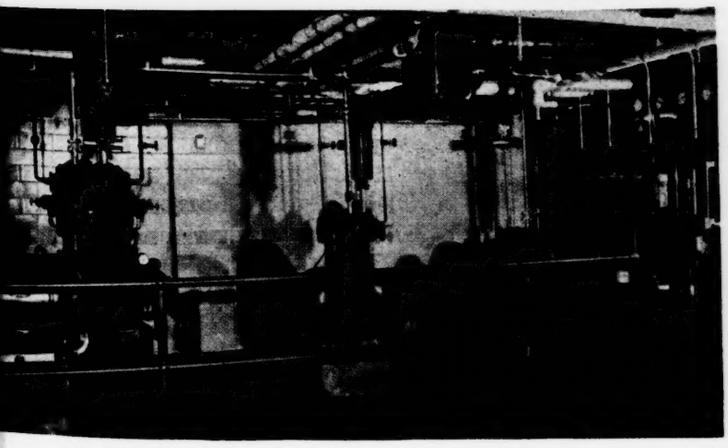
The lard roll is a direct expansion ammonia unit with capacity to chill 1250 lb of lard per hour from 150F to 70F storage temperature. With an evaporative temperature of 15F and a circulator capacity of 18 gpm, operated by a ⅛ hp motor, the hog cooler equipment handles 8200 cfm, to cool the 200 hogs averaging 170 lb each. The beef chill room handles 9500 cfm and the sales cooler 9500 cfm. Both the beef chill room and the sales cooler have brine circulators with 35 gal capacity each per minute, operating on 1/6 hp motors.

Miscellaneous equipment includes Tuttle & Bailey diffusion type grilles for the sales cooler and in the small amount of ductwork going to the second floor offices. There is also a re-heat coil control. All low pressure ammonia risers are covered with moulded cork, brine thickness. Where pipes pass through walls and partitions, they have cork sleeves. Where the pipes pass through floors, the pipes have sleeves of galvanized steel to six inches above the floor. Water piping is L-type copper tubing. The sales cooler steam line is covered with 1 in. Carey pipe covering and a 6-oz canvas jacket.

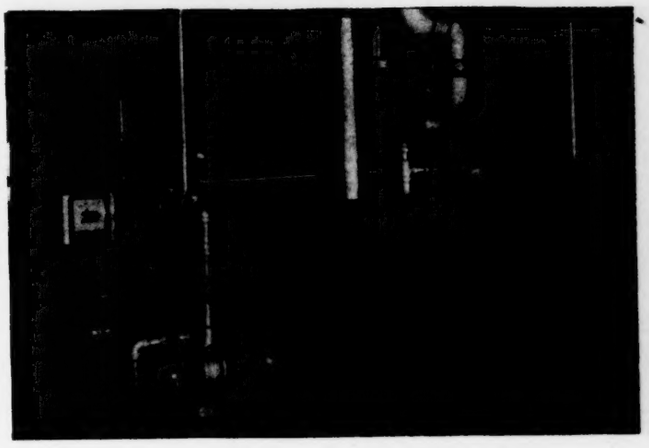
The consulting engineer was Morris Fruchtbaum, Philadelphia; the heating contractor was J. W. Praught Co., Dorchester, Mass.; refrigeration and air conditioning by York Ice Machinery Corp.

Heat and hot water for the Somerville Packing plant are furnished by this Titusville Iron Works boiler fired by an S. T. Johnson full automatic rotary oil burner.

Three York compressors furnishing 75 tons of refrigeration for meat processing, storage, and air conditioning in the Somerville Packing plant.



Heating is by a Shaub boiler return system. View shows condensate receiver, hot water heater, and water storage tank.



Packing section in the area where the vitamin capsules are handled. This space is cooled.

American Pharmaceutical Co.

installs cooling and dehydration equipment which makes possible maintenance of continuous production schedule in manufacture of vitamin capsules and effervescent tablets in New York plant.

By H. J. BRAGGER‡

IT is well known that air conditioning requirements vary widely in industrial processing. Not only does a variation exist between different industries but the proper relative humidity and dry bulb temperature will often vary from process to process within a single plant. The three installations of air conditioning equipment at the American Pharmaceutical Company are a striking illustration of this.

Capsule Manufacture

Among other things the American Pharmaceutical Company are large manufacturers of vitamin capsules. These capsules are round or oval in shape and are not to be confused with the hard filled type of capsule. Briefly, the capsules are formed in a mold by placing the fill between two thin gelatin sheets. The mold is then placed in a hydraulic compress which forms approximately 400 capsules at a time. The room containing the capsule machine must be held at 80F dry bulb since a lower temperature would tend to set the gelatin to a greater degree than desired, and a higher temperature would tend to soften the gelatin too much. Of course, cleanliness is essential as well as air motion for the comfort of workers. A moderate relative humidity of 50% is also desirable.

The capsules, which are produced at the rate of 500,000 per day, are allowed to remain in the 80F room for a few hours in order to achieve a partial set, previous to being washed with a suitable solvent. Then the capsules, the gelatin of which at this point contains approximately 30% of moisture, are carefully dehydrated in a drying cabinet, so that they emerge hard and compact, ready for sorting, inspection and packing.

The room containing the capsule making machinery and the sorting and inspection room are both held at

‡American Pharmaceutical Co., New York, N. Y.

80F and approximately 50% relative humidity by a system built around a 5 ton refrigeration self-contained air conditioning unit. A conventional system of supply and return ducts distributes the air through the spaces. The air conditioning unit contains in a single casing the necessary compressor, cooling coils, filters and fans, and temperature control is achieved by a thermostat automatically which turns the compressor on and off as required. There is no positive control over relative humidity, but this is not essential in these processes, and the sensible-latent heat ratio is such that 50% relative humidity is seldom exceeded.

Drying Cabinet

The drying cabinet offers quite a problem in dehydration since the requirements are:

(1) to dry one day's production overnight;

(2) to remove the moisture gradually from the gelatin shell in order that a superficial surface hardening does not result;

(3) to do the drying at a temperature not exceeding 80F, and

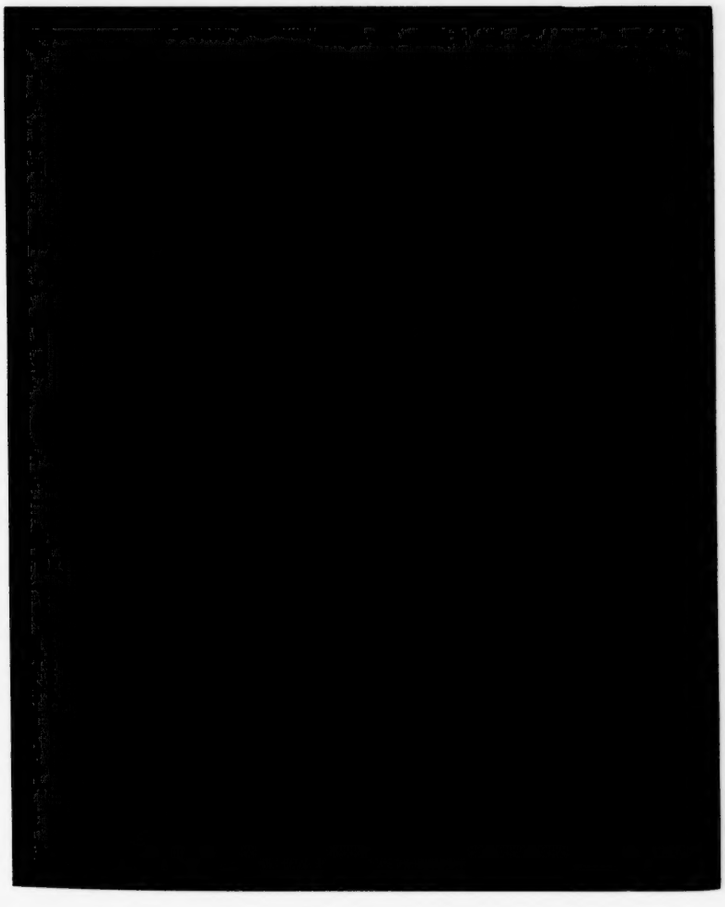
(4) to provide additional dry storage capacity for about 2 million capsules.

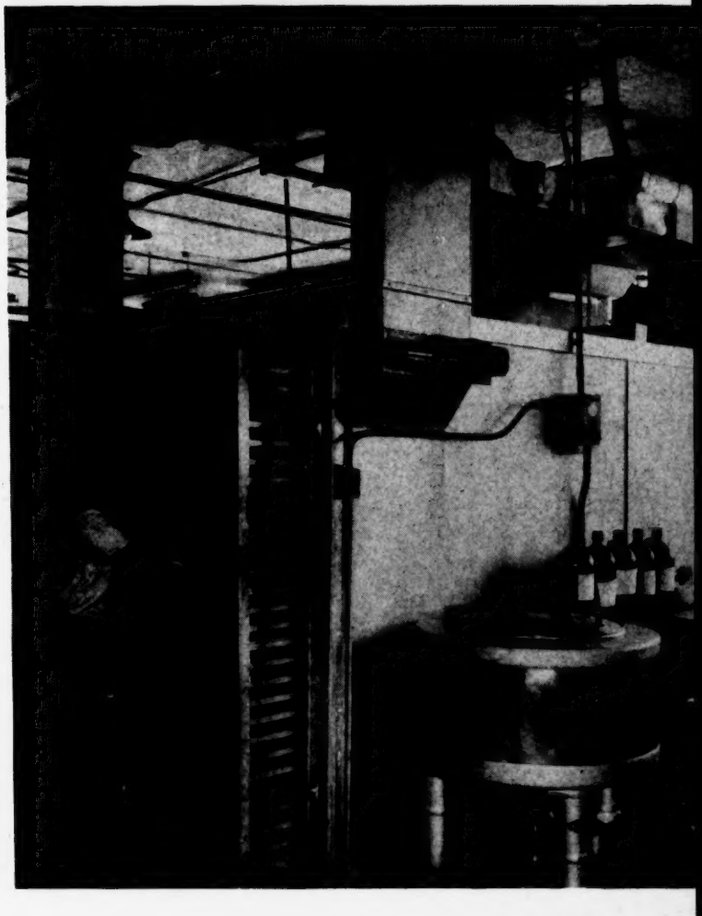
Since there is practically no sensible heat to be removed this process favored the use of chemical dehydrator equipment, and a rotary type silica gel unit handling 500 cfm is used, as shown in the drawing on page 88.

The cabinet, which has overall measurements of 10 ft x 9 ft x 8 ft high, is constructed of fiber insulating boards on both sides of studs and all the inside surfaces were given two coats of aluminum paint to act as a vapor barrier. Racks of trays containing the capsules are wheeled into place through beveled refrigerator type doors and are progressively advanced against the air flow. The silica gel unit continuously circulates 500 cfm of air through the cabinet; however, the heat input (manufactured gas) to the unit is controlled by a humidistat (set at 15% relative humidity) located in the return air duct, and a thermostat regulates the water flow through the dry air cooler to maintain the return air temperature at approximately 80F. Under certain conditions, because of the evaporative cooling effect within the cabinet, the supply air temperature will be higher than 80F. A safety thermostat, located in the supply air duct, overrides the return duct thermostat should this supply temperature exceed approximately 88F, and thus softening of the capsules near the supply outlets is avoided.

After a night at 15% relative humidity the capsules are hard and dry and are ready for packaging.

It is interesting to note that the desirable condition in this process of 80F dry bulb and 15% relative humidity represents a dewpoint temperature below 32F and therefore could not be conveniently maintained with conventional refrigeration equipment.

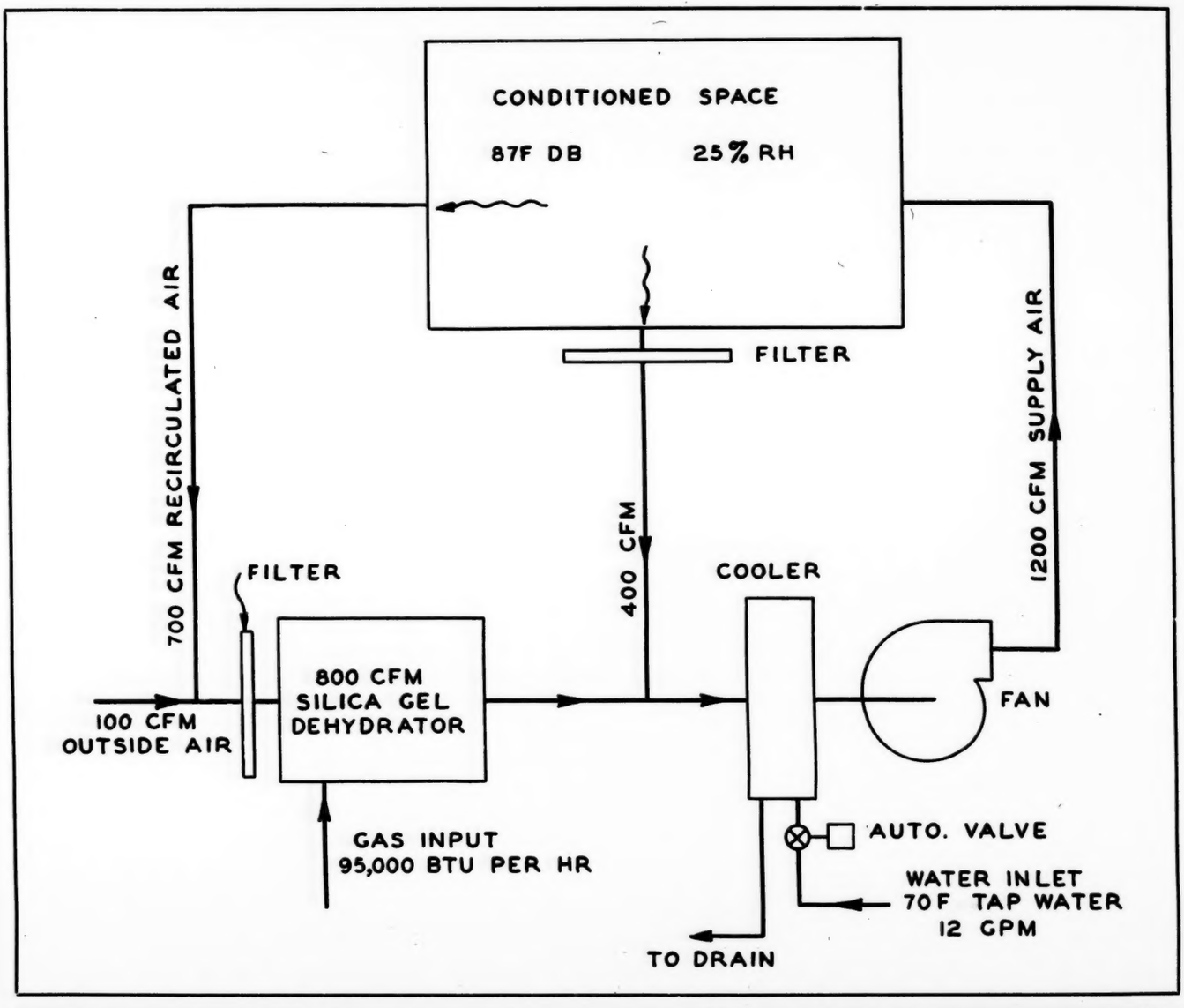


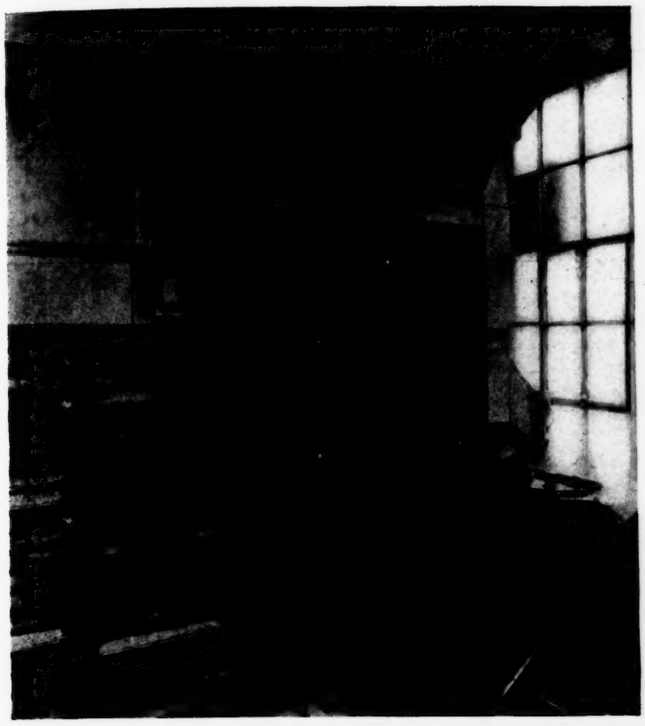


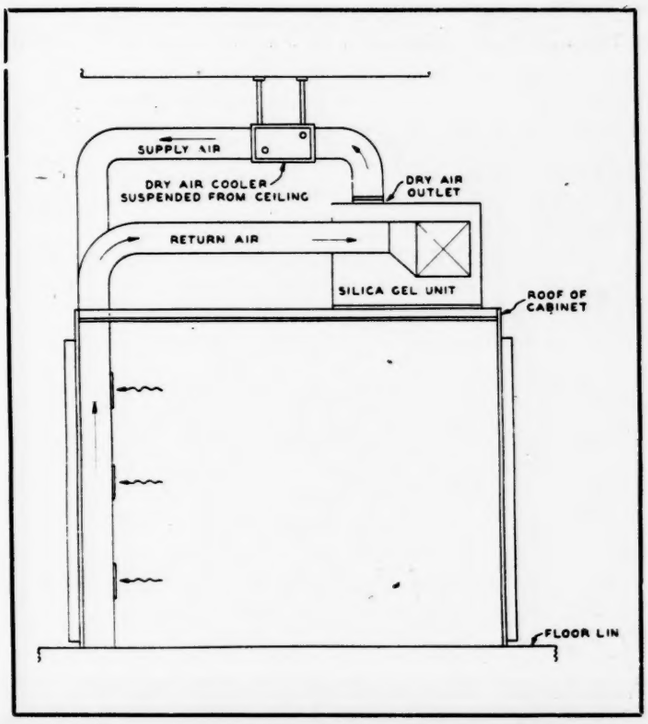
Effervescent Tablets

American Pharmaceutical Company is also a large producer of effervescent tablets. The need for manufacturing and packing this type of tablet under dry conditions has long been recognized. Excessive atmospheric moisture will cause a chemical reaction in the tablets which makes them stick to the machines, and also spoils their appearance. Moreover, when packed during periods of high humidity carbon dioxide and moisture are formed in the glass jars which causes deterioration of the tablets. Long experience indicated to the American Pharmaceutical Company that the desirable conditions for their particular tablets were 87F dry bulb and 25% relative humidity.

Recognizing that the low humidity to be maintained would impose a severe latent load on the air conditioning system, the American Pharmaceutical Company built a special room for the manufacture and packaging of effervescent tablets. The room is 20 ft x 20 ft and contains tablet making and packaging machines and normally about ten girls are employed in it. The floor and ceiling are concrete, but the partitions are similar in construction to the drying cabinet previously mentioned. That is, partitions are fiberboard insulation on both sides of studs. A double air lock door is used and all inside surfaces were given two coats of aluminum paint. A feature of the room is that drying ovens open directly into the room, the doors of the ovens forming the major portion of one of the walls. In these gas-fired ovens the various mixed ingredients in powder or granular form are dried before being compressed into tablets. The desired conditions of 87F dry bulb and 25% relative humidity is one that imposes a heavy latent load but a small sensible load on the air conditioning apparatus. Moreover, the desired dry bulb temperature is high enough to be maintained by the use of available tap water at 70F. This, coupled with the fact that exact humidity control is more important than temperature control, led to the selection of silica gel dehydration equipment for the job.







Silica Gel Dehydrator

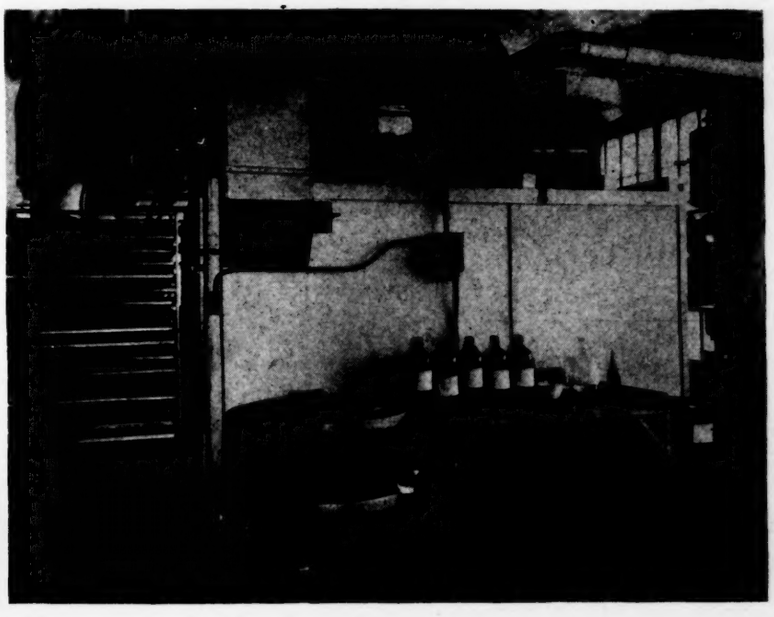
The flow diagram of the system is shown opposite. The air leaves the dehyrator at approximately 120F. This is because silica gel or other solid adsorption dehydrators are essentially heat converters changing latent heat into sensible heat which appears in the dry air as elevated temperature. In this form the heat can be easily removed by water at comparatively high temperatures. Normally silica gel dehydrators are complemented by dry air coolers which dissipate the latent heat converted into sensible heat by the dehydrator. These coolers can utilize tap water, cooling tower water, or waste condenser water. In this particular case, as indicated in the drawing, one large cooler removes both the sensible heat of conversion and the internal heat gain of the room.

A thermostat regulates the flow of water through the cooler and a thermostat controls the dehydrator, turning it on and off as required. This independent control of temperature and humidity achieves flexibility and low operating cost at partial load.

Thus it is seen that in the production of two items in a single plant three entirely different types of air conditioning systems are utilized. This illustrates the versatility of modern air conditioning equipment to meet the needs of industry, and it emphasizes the fact that there is no one system of air conditioning apparatus suitable for all applications.

Benefits of Air Conditioning

In commenting on the systems, a spokesman for American Pharmaceutical Company stated . . . "operations in the described processes would be entirely impossible in the summer on an economical basis. The chief benefit of air conditioning to us is that we can now maintain a continuous production schedule which enables us to make deliveries on time, thus enhancing our customer-relations."



The Sherwin-Williams Company

builds chemical operations building and warehouse, additions to its Chicago plant, with several types of unit heaters, motor-driven roof ventilators, and fresh air supply units with filters.

By G. S. WHITTAKER†

AS part of an expansion plan, The Sherwin-Williams Company, one of the country's largest and best known paint manufacturers, has built two new additions to its Chicago plant, One of these is a 300 x 100 ft chemical plant, the other a large warehouse building; due to the special chemical operations, dust was a problem in the former, while ventilation was necessary in the warehouse truck loading area, with heating, of course, a necessity in both.

Warehouse

The warehouse is located across the street from the main plant buildings. However, it is near the plant entrance gate and thus extremely accessible for shipping by truck. Only a short distance away, on the same side of the street, is the chemical products building. To the rear of the two structures is a large company-owned area upon which future Sherwin-Williams buildings will be located as the contemplated expansion program progresses.

While a large portion of the floor area of the warehouse is used for storage purposes, space was set aside for progressive packing and shipping operations. The continuity of column spacing is such as to provide for easy expansion of the building itself when, in the future, this may become necessary or desirable.

An interesting feature of the warehouse's operation is the means that has been provided to transport finished materials from the manufacturing structures on the north to the new building itself. A tunnel passes under Kensington Avenue from the manufacturing group of buildings, and in this tunnel is a continuous conveyor system. Arriving under the warehouse, the conveyor passes up through the floor and becomes an overhead carrier. By means of this conveyor, materials are carried to handling points.

Full and complete shipping facilities are provided. Along the front or north end of the building, there have been installed six 29-ft, electrically-operated, overhead doors, and one 17-ft door. Trucks back in through these doors to an indoor loading platform. Thus, 20 trucks or truck trailers can be accommodated at one time, their loading expedited by the fact that they are indoors and protected from the weather.

Along the southern side of the warehouse extends a two-track railroad siding, with suitable loading platforms for freight cars. A length of more than 200 ft of this double-tracked spur is under the building's roof. At the point where the tracks enter the building, electrically-operated overhead doors protect the space from the weather. On the opposite side of the building are

†Engineer, Albert Kahn Associated Architects & Engineers, Inc., Detroit

Interior of the Warehouse showing the line of downward flow unit heaters along the wall.

conveniently spaced outdoor loading decks, which accommodate additional trucks.

Except for its northwestern corner, which has second-story office space, the building is one-story throughout. It measures 327 ft wide by 680 ft deep. Its total floor area is in excess of 230,000 sq ft, when second-story office space is considered.

Column spacing within the building is 40 ft north and south, or its length, and 60 ft east and west, its width. From the floor to the bottom chords of the overhead trusses the clearance is 12 ft.

The designers of the building, Albert Kahn Associated Architects and Engineers, Inc., laid great emphasis upon plenty of glass area, so that an abundance of daylight would enter the warehouse. Exterior walls are of speed-wall tile, which extends upwards from a concrete foundation to a sill six ft above the floor elevation. Continuous steel sash tops the sill to a height of 7 ft, thus providing plenty of natural lighting area.

The building has a monitor-type roof, which provides an additional large amount of glass area. The roof is of cement tile. Interior walls of the warehouse are also of speed-wall tile.

Warehouse Heating

Being primarily a warehouse, this building presented generally a rather simple heating problem, excepting for a few difficulties encountered in the heating of the truck well space and the area enclosing the railroad freight car loading platform.

The steam service and pump discharge lines were brought to the building in a 4 in. 100-lb main in pre-sealed underground conduit to a basement space in the northeast corner, connecting to the company's 12 in. steam line in the street. The insulated pipe units, with filler insulation encased in 8 in. casing, was laid on a bed of crushed stone. High pressure steam traps were installed at low points in the piping with discharges connecting to the underground condensate return piping. From the entrance of the piping to the building, the steam lines were supplied to the various systems at the pressures required. All the returns from these systems were run back to the basement where engineers located a duplex pump and receiver set which discharges the condensate back to the receiver in the plant's power house.

The warehouse is of typical monitor-type construction, making possible a maximum amount of light. To offset the heat loss, heating surface was installed in the form of 29 vertical type down blow unit heaters. The heaters were located in such a way as properly to diffuse the heat along the aisles and in the working areas so that it would not be blocked off by the piles of merchandise and racks of materials occupying the building's main area. Some of these heaters have two-way diffusers which distribute the warm air along the aisles; most of them, however, throw the air in all directions.

The indoor section of the railroad siding is heated by means of 20 inverted blower-type unit heaters, with directional outlets for distributing the air in and around the freight cars while they are being loaded.

All the heaters thus far described are supplied by steam at 25 lb pressure, supplied through a pressure-reducing valve from the 100-lb steam line that serves the building. All the steam and return piping that serves the heaters was run above the bottom chords of the trusses, so that every possible foot of head-room would be preserved for storage space.

Interior of the Warehouse building showing the elaborate system of conveyors and, at the upper right, one of the downward flow unit heaters.

All steam supply piping over 3 in. in the building was fabricated of standard black steel pipe with welded fittings and with all joints arc-welded. For piping smaller than 3 in. standard screwed and flanged fittings were used. The piping is covered with spun glass insulation with canvas jacket painted in color to match the surroundings.

In the two-story office area of the building, heat is provided by wall-hung, cast iron radiators. Steam is supplied to this area under a pressure of 5 lb. An appropriate reducing valve couples the line to the 100-lb source of supply in the basement in the northeastern corner of the plant. The condensate returns from these radiators are carried in an underground trench back to the condensate pump and receiver set in the basement.

Since the Chicago Department of Buildings ruled that the indoor truck wells at the north of the building constituted a garage, a ventilating as well as a heating problem arose. Hence, the engineers decided to exhaust the air out through grilles located near the floor, into a trench at the rear of the truck well area.

This trench carries the exhausted air to a large fan in the basement, whence it is discharged up through a gooseneck on the roof. To compensate for this exhaust, heated fresh air is forced into the area through large blower-type unit heaters which maintain a temperature of approximately 60F while the loading of trucks is in progress.

Each unit heater is controlled by a White-Rodgers three-position starter and thermostat. These starters are marked *On, Off* and *Automatic* to allow the units to be run in the summer without the necessity of disconnecting the thermostats.

Toilet rooms in this building are mechanically ventilated by means of a system of vent ducts and registers which are connected to exhaust fans located on platforms suspended from the roof trusses.

Steel sash in the room monitors are fixed, and this necessitates the use of some kind of mechanical ventilation in this area, particularly in the center of the building. Ten ventilators, each with a capacity of 10,000 cfm have been installed. These are equipped with snow-proof hoods, automatic back draft louvers, and motor-driven fans. Each ventilator, which takes care of about 5,000 sq ft of roof area, is controlled by an automatic push button starter, with phase failure and voltage protection, and a fused line switch. A motor operated mechanism is interconnected with the fan starter so that the intake damper will close when the starter is in the *off* position and open when in the *on* position.

Drip traps on the high pressure lines are of the bucket type. Those on the 25-lb lines are of the combination float and thermostatic type. Radiator and low pressure traps are of the thermostatic type.

Chemical Products Building

A small structure, the chemical products building was designed for special chemical operation. It is isolated to some extent from nearby structures. Similar buildings will be added as the needs require.

The building was so designed that its interior could be kept extremely clean at all times. This was a requirement of the Sherwin-Williams Company. Spaces in which dust might lodge were kept at an absolute minimum. Hence, trusses were eliminated and bent beams used for roof support instead.

As interior wall space was desired, window sills were placed high above the floor—nearly 14 ft. Piping, tanks and other apparatus are located along the walls. Extending to over 8 ft above the sill is continuous steel sash which permits an abundance of light to enter the building. The exterior wall of the building, up to sill height, is of speed-wall tile. Interior walls are of this same material.

Topped by a single monitor 210 ft long by 60 ft wide, the roof is wood plant, composition-covered. In the monitor, the sash is permanently fixed, so that three huge vents were provided in the roof and used in conjunction with the mechanical ventilation system.

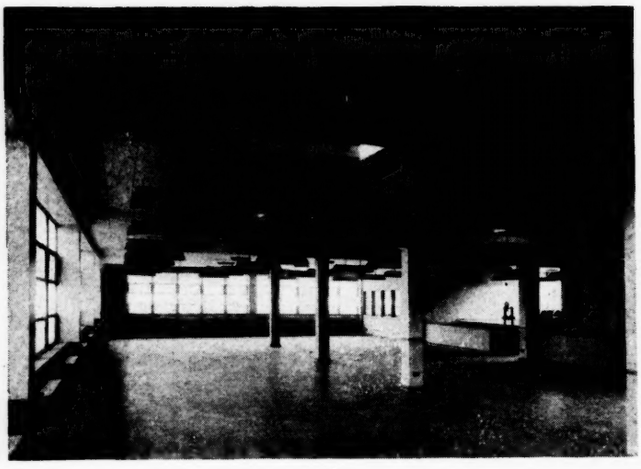
Attached to the south side of the building, near the center, are a one-story 36 x 28 ft filter room and a 20 x 12 ft mill room. In the filter room explosion-type vents are used in the sidewalls and the roof of the room is equipped with loose scuttles.

Concrete floor slab, covered by an acid-resisting topping, prevails throughout the building. Column bases are covered with the same material.

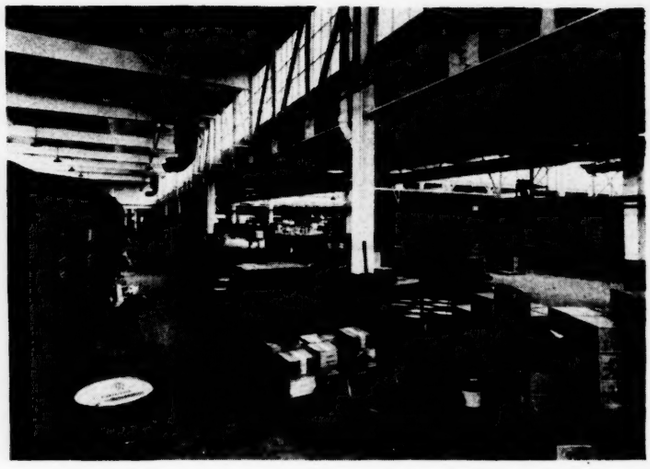
Heating and Ventilating

A 12-in. 100-lb pressure steam supply main, carried overhead on a steel structure, supplies steam to this building and will also furnish steam for several future buildings. A 6-in. branch from the 12-in line extends into the building and connects to one 2½-in. and two 3-in. steam services. The 2½-in. service used for heating is connected to an 8-in. 5-lb steam main through a pressure regulating valve, condensate accumulator and sediment strainer.

The nature of the operations in this building is such that a heating and ventilating system had to be designed not only to provide heat when manufacturing conditions were not going on, but to provide a constant flow of fresh, clean, heated air during working hours. Further, it was necessary to replace air exhausted



Interior of the two-story office area of the Warehouse building which is heated by steam and direct radiators. Condensate is returned by pump.



The shipping Department illustrating the use of directional outlets supplying heated air in and around the freight cars while they are being loaded.

through the hoods on the company's equipment.

With these conditions in mind, a combination of units was selected for the job. First, radiators were used in the small offices, toilet rooms and other areas where drafts would be objectionable and where no mechanical exhausts were provided. Second, since the factory, or manufacturing area, offered a difficult problem, this was solved as follows:

THIS INSTALLATION

Designed by Albert Kahn Associated Architects and Engineers, Inc., Detroit.

Ten vertical type unit heaters were selected and located near the roof to heat the building when it was not in use. These heaters are controlled by push starters and thermostats.

Steam supply piping for this building was fabricated of standard black pipe and screwed fittings on piping 5 in. and smaller with flanged fittings used on 6 in. pipe and over. Spun glass insulation was used for pipe covering. Steam flow meters are used in this building, as in the Warehouse building, for measuring the steam input. One meter is used for heating steam and one for process steam.

Third, there was the dual problem of heating the area when the plant was operating and replenishing exhausted air with fresh air at the required temperature and degree of air cleanliness. To meet this problem, a system of fresh air supply units, complete with coils, filters, and face and by-pass dampers was installed on the roof in small houses. These were designed either to supply 100% fresh, heated air, a mixture of fresh and recirculated air, or 100% recirculated air. Each unit has a capacity of 8,000 cfm and is equipped with both a fresh air intake and recirculating dampers which can be set in any desired position by means of a manual switch located on a column near the heater. The dampers are operated by small motors.

Each of the units is controlled by push button across the line starters, complete with unfused line switches and a bull's-eye.

The face and by-pass dampers which control the amount of heat delivered to the building are controlled by thermostats which, in turn, operate modulating type motors mounted on the units for purpose of setting the dampers in the positions required to heat the building properly.

By using this type of heater, steam pressure must be maintained in the heating coils of the unit at all times.

Fresh air supplied to the building is exhausted in two ways. One is through exhaust hoods on the process equipment. The other is by means of the large exhaust fans which were installed above the roof of the building for this purpose.

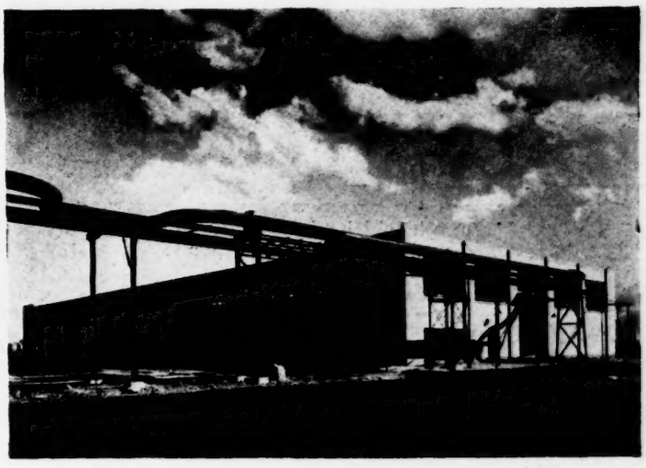
The roof units are located in small penthouses. They are complete with shutters, screens, and access doors which permit quick servicing and easy repairs.

All the starters, motors, thermostats and allied equipment are of the explosion-proof type as required by the code for all buildings in which inflammable materials are used and processed.

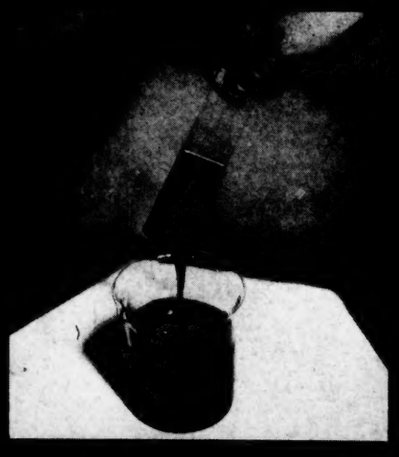
A filter and sulphonation room is attached to the south side of the main building. This is heated by a Mono-flo high pressure hot water system supplied by two converters. Steam controls regulate the water temperature in the converters while thermostats mounted in the manufacturing space with remote bulbs in the filter and sulphonation rooms operate the circulating pumps.

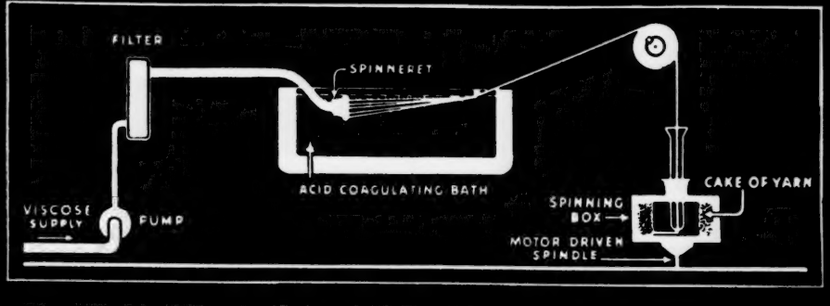
Condensation from the unit heaters, converters and steam main is returned through an overhead system of piping to a 15,000 sq ft capacity vacuum pump connected to a 40,000 sq ft capacity condensation pump which also handles the condensation from the process system.

The heating contractor for both buildings was Heating Systems, Inc. of Chicago.



(Left) Interior of the Chemicals Products building showing the type of construction, a downward flow-type unit heater in the monitor to the left and, still further to the left, a conventional type unit heater, and the method of taking off the unit heaters from the piping. (Right) The Chemical Products building is heated by steam supplied through this 12 in., 100 lb line designed to accommodate further buildings as well.




FILTER
SPINNERET
ACID COAGULATING BATH
VISCOSE SUPPLY
PUMP
SPINNING BOX
CAKE OF YARN
MOTOR DRIVEN SPINDLE

American Viscose Corp.

completely air conditions its Front Royal, Virginia, plant since air conditioning is an absolute necessity in every step of the rayon manufacturing process carried on at this plant.

By J. J. BURKE†

SINCE the manufacture of rayon is essentially a chemical process, rayon can be successfully and profitably produced only as long as all of the chemical reactions are accurately controlled. It has long been recognized that a vital factor in this control is the maintenance of proper air conditions. So important is air conditioning to rayon manufacturing that in the modern plant it is used in one form or another in every step in the process.

For years designers and operators of rayon plants have given much attention not only to the most desirable conditions which should be maintained but also to the best methods of achieving the desired conditions. As a result of this attention, the air conditioning systems in the modern rayon producing plant provide an excellent example of the application of air conditioning to manufacturing operations.

One of the most modern rayon producing plants in this country is the new plant of the American Viscose Corporation at Front Royal, Virginia. This plant is located on a 425-acre plot just outside of Front Royal on the shores of the Shenandoah River. When all of its equipment is installed it will have a capacity of 50 million pounds of rayon per year.

Buildings

Practically all of the buildings except the powerhouse are of the one-story type with walls made of red brick lined with buff and white glazed brick. The factory buildings are all of the windowless type with flat roofs and no skylights. The power plant is said to be one of the largest and most modern in the south and is equipped with five turbine generators with an output of 24,000 kw-hr and three steam generating units each with a capacity of 225,000 lb of steam per hr. The boilers are fired with pulverized coal and there are two pulverizing mills each with a capacity of 12,000 lb per hr.

Water Supply

Extremely large quantities of water are needed for rayon plants for manufacturing processes. To supply this demand, a number of large pumps with a total capacity of 6,000 gpm have been installed to force the water from the river through one-half mile of 36-in. pipe to the water treating plant. In this plant the water is filtered, treated and purified. The water is stored in a 3½ million gallon supply pond from which it is drawn as needed either by the boilers or in the manufacturing processes.

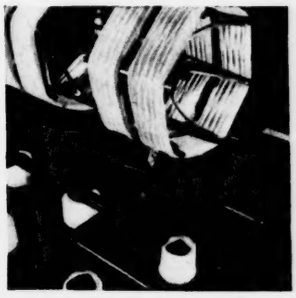
Outstanding Features of the Plant

Among the outstanding features of the plant are first, that it is a windowless plant and second, that it uses masonry tile for the main air ducts.

The plant was made windowless because it is more economical to build a plant of this type without win-

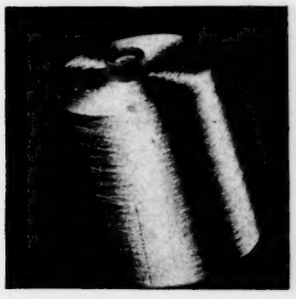
†American Viscose Corporation, Wilmington, Del.

9 Cake of rayon as removed from spinning machine.

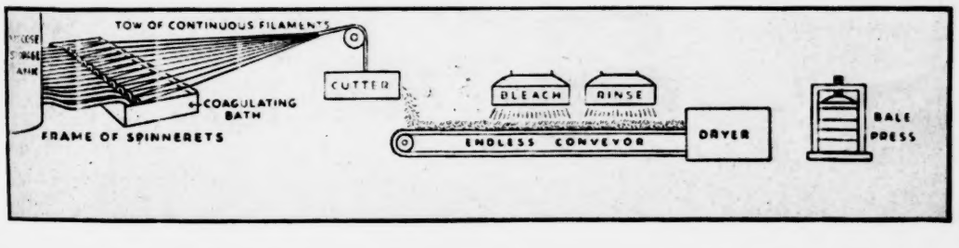


10 Yarn is reeled into skeins before washing and bleaching.

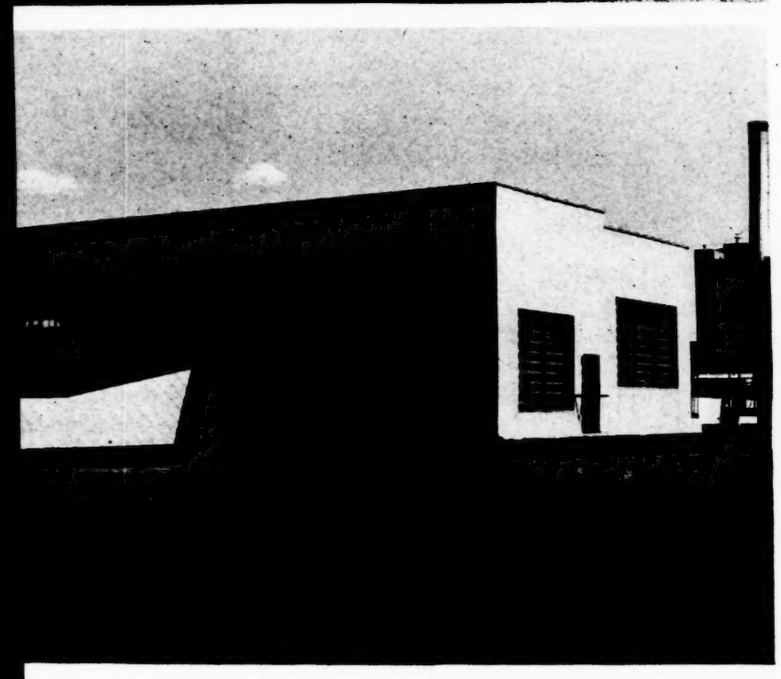
11 Winding room where rayon is wound in cone form.



12 Completed cone of viscose rayon yarn before shipping.



9A Schematic diagram of process for producing staple fiber rayon.



Above, Three and a half million gallon spray pond in which is stored the water required for process work, for air conditioning and for steam boilers. Below, one of the air conditioning penthouses showing masonry tile air distribution header on the roof. Masonry tile headers are used because of the high moisture content of the air.

dows than with windows. When windows are used in a one-story plant it is necessary to use a saw-tooth roof construction. The cost of this roof is considerably greater than the cost of a flat roof. At the same time it is necessary to install the same lighting fixtures in both types of plants since a rayon plant operates 24 hours a day, 365 days a year. Thus, for rayon manufacturing a windowless plant is more economical, and provides better lighting conditions than the usual window type building.

The second outstanding feature of this plant is that masonry tile instead of sheet metal ducts are used for the main headers. Most of the air conditioning apparatus rooms are located in penthouses on the roof and the masonry tile ducts are run from the side of the penthouse across the top of the roof. The 1½ in. cork insulation used on the roof also covers the ducts, which are then finished with the usual roof materials so as to become a part of the roof.

Openings to the various air distribution ducts are taken off at the bottom of the masonry tile ducts. These ducts run at the ceiling of the plant at right angles to the main duct. They are constructed of sheet metal and, as far as possible, are all of the same size and are not reduced in cross-sectional areas from one end to the other. This was done to save labor since one standard size of sheet was used to construct the ducts. There is approximately 5000 lineal feet of this standard duct in the plant. The sheets were made up in the rolling mill to the proper size so that no cutting was necessary.

The reason that masonry tile ducts were used for the main headers is because of the high moisture content of the air which tends to cause corrosion of sheet metal. Moreover, their use facilitated their location above the roof thereby saving four to five feet of head room. Since the sheet metal distribution ducts are highly standardized there will be very little expense and trouble to renew them when they rust out.

Rayon Manufacturing

Probably the best method of explaining the application of air conditioning to the manufacturing process is to describe the manufacturing operations from the time the raw materials arrive to the time when the finished rayon is ready for shipping.

Although it is possible to produce rayon from many substances, wood pulp and cotton are used almost exclusively since these substances have the purest cellulose in the most readily available state.

Steeping

The raw material in the form of cotton and wood pulp sheets is stored in a warehouse. When needed the material is moved to an air conditioned combined storeroom and soda room where it is allowed to remain for from one to two days to allow the sheets to reach the proper moisture condition. The next step is to submerge the sheets in a caustic soda solution to change the cotton and wood cellulose to sodium cellulose. By having the sheets at a constant moisture condition when they are placed in the steeping bath, the reaction can be accurately controlled since the time to complete the steeping operation remains constant regardless of the weather conditions.

Shredding

After the steeping process has been completed the mercerized sheets are squeezed to remove the excess caustic soda solution and are dumped directly into the Pfleiderers (shredders) which are located at the end and just below the steeping baths. In the Pfleiderers the cellulose sheets are broken up into a fine white matted crumb.

The room where all of these operations are carried on is maintained at 70F and 55% relative humidity through the entire year.

The 55% relative humidity is maintained to properly condition the wood and cotton sheets and also to prevent condensation on the cold pipes and jackets, while the 70F temperature is maintained to help con-

trol the temperature of the steeping tanks and Pfleiderers. The Pfleiderers are equipped with refrigerated brine jackets to remove the heat due to the shredding and chemical action. This brine is supplied at temperatures of about 10F.

Since there are no toxic fumes and since there are only about 20 workmen in this room about 80% to 90% of the air is recirculated. The total air conditioning load of this room is about 100 tons of refrigeration which is obtained from brine to water heat exchangers.

Ageing

The crumb is then dumped into portable ageing tanks which are taken to the ageing room where they are stored for a predetermined time at 73F. There is very little heat released during the ageing process so that the problem of maintaining the proper temperature is relatively simple. Humidity does not have to be controlled at this point since the cellulose is in closed metal tanks. This room is cooled by brine coils.

After the ageing process has been completed, the mercerized crumb is taken to the churn room where it is mixed in churns with carbon disulfide and an orange colored substance known as cellulose xanthate is formed.

Churning

The conversion of sodium cellulose into cellulose xanthate is accomplished in slowly-rotating churns. About 750 lb of cellulose and about 75 lb of carbon disulfide are loaded in the churn which is slowly rotated so that the cellulose crumbs are effectively mixed with the carbon disulfide.

To control the rate of reaction in the churns refrigerated brine is passed through the jacket of the churn and the room temperature is held fairly constant at about 75F - 80F year round. Humidity control is not important in this since the cellulose is not exposed to the air.

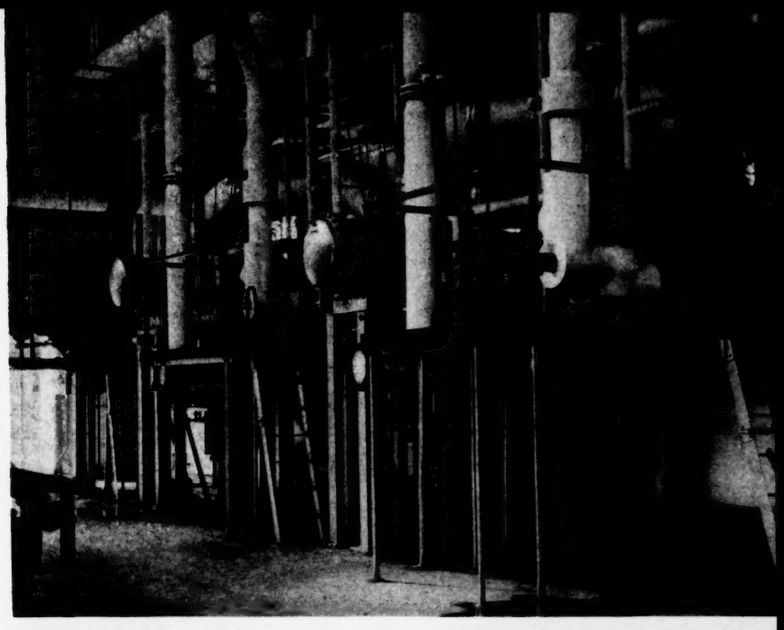
The chemical reaction which takes place generates heat so that the temperature within the churn rises and the pressure increases slightly. In about two hours the pressure falls and a vacuum is formed indicating that the carbon disulfide has been adsorbed. The color of the crumbs now has changed from white to orange and in this form the cellulose is soluble.

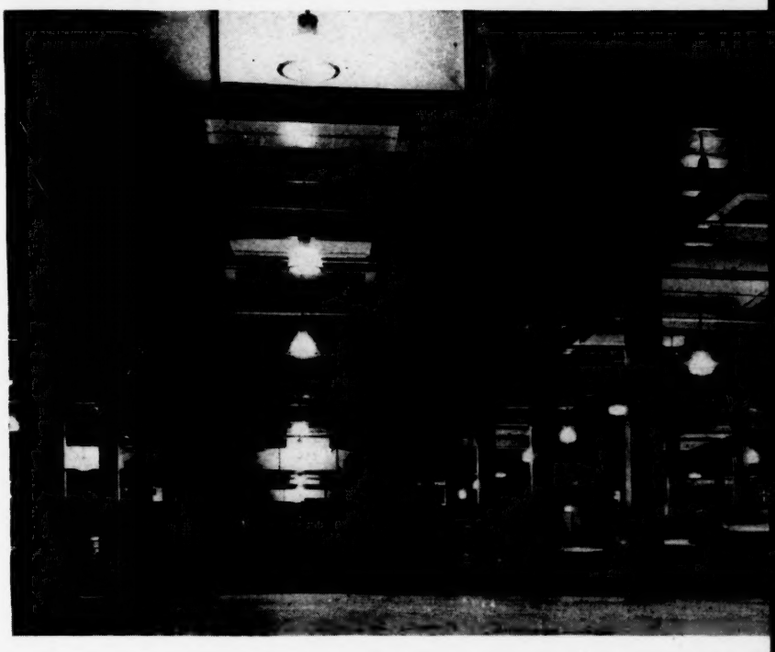
Ventilation of Churn Rooms

Inasmuch as all churns are kept closed whenever carbon disulfide is introduced into them, the ventilation requirements of the churn room are not severe. However, to guard against any possible contamination of the air in the working spaces large amounts of outside air, approximately 20 air changes per hour, are continuously introduced. This air is passed through conditioning equipment to wash and clean, and during the winter, to heat it. Evaporative cooling is used to keep the room temperature below 85F during the summer.

Dissolving

In the dissolving machines, the cellulose xanthate is mixed with a diluted solution of caustic soda. The heat released during the process is removed by passing refrigerated brine through a cooling jacket. The solution formed resembles honey in color and consistency.





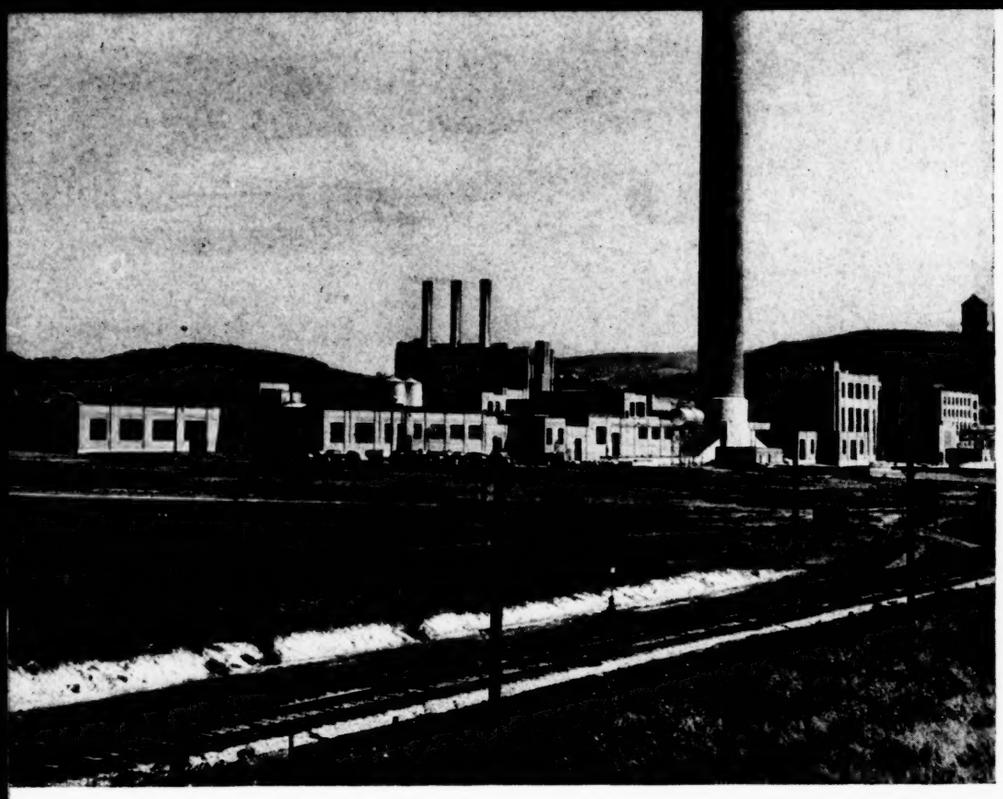
Above, Three 300-ton Carrier centrifugal refrigerating compressors used for cooling calcium chloride brine to 10F for process work. These compressors also supply cooling for part of the air conditioning space. Below, combined storage and soda room where the cellulose sheets are conditioned before use. Air conditions in this room are maintained at 55% relative humidity and 70F during the entire year.

Ripening

To prepare the viscose solution for the spinning operation the solution is carefully filtered and passed through deaerators which remove impurities and air bubbles which would cause breaks in the rayon thread. It is then stored in ripening tanks. The temperature of the ripening room must be accurately controlled since it has a considerable effect on the time of ripening. Humidity control is not necessary since the solution is not exposed.

Spinning

The viscose solution is then pumped under pressure



Front Royal plant of the American Viscose Corporation which will have a maximum capacity of 50,000,000 lb of viscose rayon.

to the huge especially designed spinning machines which are located in a large room which covers an area of more than nine acres. In these machines the solution is forced through very small holes in a platinum cuplike device known as a spinneret. The fine jets which are produced are passed through a coagulating bath to form the filament. The many filaments formed are twisted into thread by a revolving spindle and are collected in a revolving circular box. The centrifugal force developed by the revolving box forces the thread to the side of the box and it forms an annular cake.

During the spinning operation a considerable amount of hydrogen sulfide gas is given off. To prevent this gas from getting into the spinning room the machines are enclosed by housings with light weight Vinylite plastic windows. Large amounts of air are withdrawn from these machines so that a slight vacuum is maintained within them. This air is exhausted by means of large fans and discharged to the outside through a 300 ft high fume stack.

Ventilation of Spinning Room

In the spinning operation it is desirable to limit the air temperature to about 90F during the summer and to keep the relative humidity at least 70% or higher. Variations in temperature and humidity may cause crystallization of the solution which causes breakage of the thread.

Since the air for the spinning machines comes from the spinning room it is necessary to maintain not over 90F and 70% relative humidity in the room during the summer and approximately 75F and 70% relative humidity in the winter.

Since a great deal of air is exhausted from the spinning machines, all air supplied to the spinning room through the air conditioning apparatus is outside air. This air is drawn in through outside air intakes located above the roof, preheated in the winter, washed and humidified to a minimum dew point of approximately 70F, reheated as required, and discharged by large supply fans to the masonry tile supply ducts. During the summer evaporative cooling is obtained by means of the adiabatic saturating effect of the air washers.

Cake Storage

The yarn which is wound on the inside of the spinning box is known as a cake. These cakes are removed from the spinning box and are stored in a cake storage room. This is the first part of the process which is not continuous and the cake storage room is provided to take up any lag between the spinning and the finishing operations of the yarn. Up to this point the plant must be operated by a continuous process twenty-four hours a day and 365 days a year but beyond this the operation usually is on a one or two shift basis.

The cakes when they are taken from the spinning boxes are saturated with acid and are subject to rapid deterioration unless they are kept at a temperature of 85F and 100% relative humidity. Therefore, the storage room is maintained at these conditions by a spray type air conditioning system.

Washing

From the cake storage rooms, the rayon cakes are placed in a washing machine where they are first thoroughly washed, then desulphurized, acidified, bleached and washed. The cakes are then partially dried in a centrifugal drying machine.

Since the same conditions are maintained in both the washing and spinning room and since both of these rooms require all outside air, the conditioned air is first supplied to the reeling room and then is discharged into the spinning room. This has the advantage that the heat gain of the washing room helps heat the spinning room during the winter and also it makes possible excellent ventilation of the washing room. Evaporative cooling equipment is used for conditioning the air going to the washing room.

Drying

The final drying process is an extremely delicate operation. The utmost care is taken to dry uniformly and at exactly the proper rate. After the cakes are taken from the centrifugal drying machine they are placed on rods which are loaded on skid-type racks. The racks are then loaded into drying rooms in which the air is very uniformly circulated. The air conditions in the dryer are varied in accordance with a prearranged time-temperature-humidity drying schedule which is worked out in the laboratory for each type of rayon being manufactured. In order to achieve greater uniformity of drying, the air is alternately circulated from the bottom of the dryer up to the top and then from the top towards the bottom. The timing of the alternations of the air supply can be varied at will to suit variations in drying requirements caused by differences in the size of cakes and types of rayon being processed. After being dried, the rayon cakes are left in the dryer under controlled air conditions of approximately 100F and 65% relative humidity in order to bring the rayon to the proper regain. Following this, the rayon cakes are then transferred to the coning room for the final step in the process.

The final operation is to put the rayon yarn on cones. This operation is performed by the winding machines located in the coning room. This room is completely air conditioned and the temperature is kept at a maximum 80F and a relative humidity of 55%. The reason the temperature is limited to 80F is to prevent the perspiration on workers' hands from soiling the yarn. The 55% relative humidity is maintained so that the yarn will have the legal moisture content when it is shipped. If the relative humidity in this room is too low the rayon will have a lower moisture content than legal. Since rayon is sold by the pound this would represent a considerable loss to the manufacturer. It is interesting to note that in some of the earlier rayon plants the installation of air conditioning in the finishing department has shown enough of a return to pay for the installation within a few months.

Air Conditioning Equipment

It is interesting to note that the air conditioning system in the coning room differs from the equipment in other sections of the plant in that the cooling is supplied by a separate synchronous motor electrically driven 300 hp, 350 ton centrifugal compressor unit and not by the cold brine system.

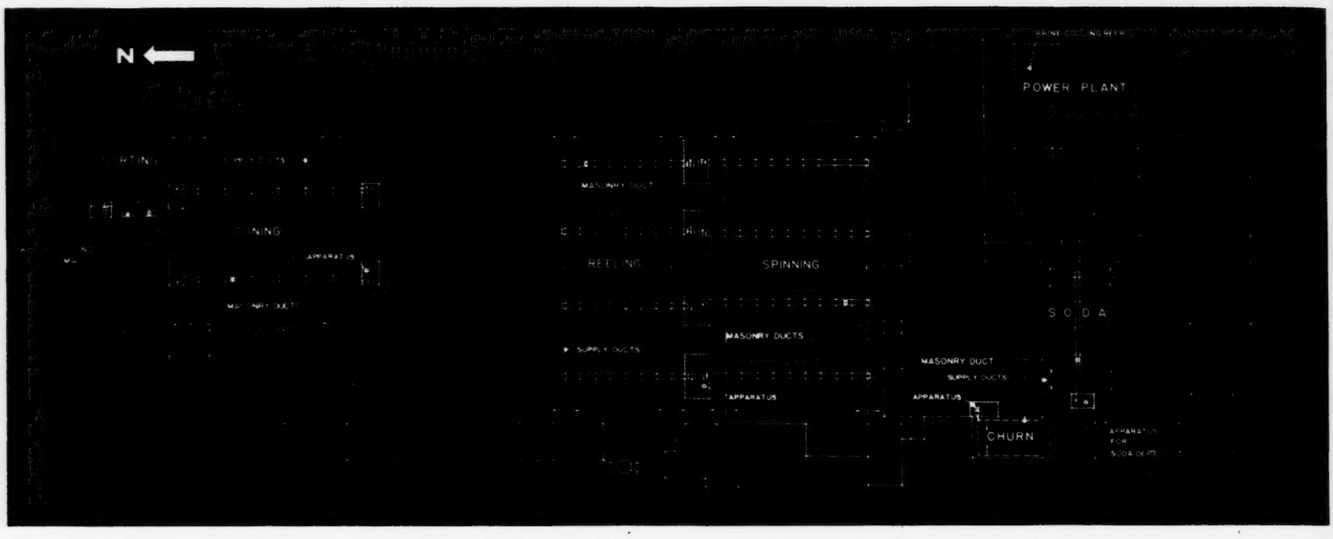
This unit consists of centrifugal compressor and a marine type cooler and condenser. The unit cools water to approximately 52F. The temperature of the outgoing water from the refrigeration is automatically controlled and recorded by means of a pneumatic controller which, through the action of a pneumatic motor, varies the suction pressure of the compressor.

Chilled water is supplied in the summer to two sets of air conditioning apparatus located on the roof of the coning room. Each apparatus consists of an outside air and return air chamber, dehumidifier, throwaway type filters, recirculating pump, water heater for maintaining the proper dew point in winter, finned type reheater, coils and a fan. The fan discharges the supply air into a masonry tile duct located on the roof of the coning room. The air from the tile ducts is discharged through the roof into the galvanized steel ducts located at the ceiling of the coning room. The ducts in the coning room run at right angles to the tile ducts on the roof. The air is distributed from the galvanized steel ducts through side wall, diffuser-type outlets having a double set of vanes, the front set horizontal and the back set vertical.

Above, section of the spinning room looking down an aisle between the rows of spinning machines. These machines are housed in cabinets with light weight vinylite plastic windows. Relative humidity is maintained at at least 70% in this room. Below, coning room where the rayon is wound on cones. Room is completely air conditioned and temperature is not allowed to exceed 80F and relative humidity is kept at 55%.

Brine System

A brief description of the brine system is of interest. In many parts of the rayon process considerable heat is produced. This heat must be rapidly removed in order to control the process. To remove this heat chilled brine at 10F is circulated throughout the plant.



Plan of building layout of American Viscose Corporation plant at Front Royal. Raw material enters warehouse at right and flows through the soda room, churn room, spinning room, reeling room to coning room at the left.

This brine is supplied by the three centrifugal refrigeration machines located in the power house.

The chilled brine also supplies the cooling for the conditioning system for the soda room. In this case heat transfer equipment is used to cool water which is used in the air conditioning system.

Brine Cooling Refrigerating Equipment

Three 300-ton capacity centrifugal refrigerating compressor units are used for cooling calcium chloride brine to 10F. Each unit consists of a centrifugal compressor, and a marine type cooler and condenser. Two of the units are driven directly by 600 hp turbines using steam at 415 lb gauge and automatically bleeding at 25 lb or condensing at a vacuum of approximately 26 in. hg. The third unit is driven by a 600 hp, 1200 rpm synchronous motor through a step-up gear. Temperature control of the brine is obtained by recording controllers which vary the turbine speed in the case of the turbine driven units. The brine temperature leaving the motor driven unit is controlled by automatically varying the suction pressure of the compressor.

Douglas Aircraft Company, Inc.,

builds cold room for testing airplane parts at temperatures as low as 104F below zero.

Coldest spot in the United States is not Havre, Mont., as the weathermen have it, but a little slice of Santa Monica, Calif., in the Douglas Aircraft factory.

Here, at the Douglas plant is a scientific icebox that, in a couple of hours, can bring the temperature in it from average summer reading to around minus 40F and frequently down to 104F below zero.

Function in this cold room is to simulate the conditions and effects of extremely low temperatures on the various component parts of high-flying aircraft. Since at 35,000 ft the stratosphere has a near-constant temperature of 67F below zero, the motor, metals, alloys, plastics and other materials, not to mention the pilots and crews, must be thoroughly pre-tested and proven.

Under such a frigid slipstream the metal skin of a bomber tends to shrink away from its coat of camouflage paint, which, thus loosened, sometimes sheds like dandruff on return of the plane to earth and sea level.

Since all the metals, alloys and plastics used on airplane controls have widely-varying coefficients, the contraction caused by intense cold tends to bind the system here, loosen it there. Lubricating oil, guaranteed by the manufacturers to function smoothly on controls above minus 40F, rapidly freezes below that point.

The trick of attaining the cold room is done by a combination of CO_2—dry ice—and methyl alcohol. Agitated together and pump circulated through a heat exchange unit, this potent bar mixture will deflate the most self-satisfied thermometer from a cordial plus 80F to rock-bottom minus 104F in two hours even.

This bit of Antarctic climate in Southern California is corralled in a space some 14 x 16 x 8 ft. The room is also insulated with 12 in. of fire- and corrosion-proof spun glass in fibrous form, at 3½ lb per cu ft.

The testing program which this room is used for includes studies of fuel, oil and hydraulic systems, controls, structural parts, insulation, heating, bearings, lubrication, tolerances, metal fatigue, windshield deicing devices and many other pieces of equipment.

Already some astonishing things have been learned from studies in this intense cold. For instance, rubber hose connections go completely haywire. They first stiffen, then become brittle and crack open longitudinally or snap in two under but little stress or vibration. This applies to hose of the heaviest fabric-ply as well as those not reinforced. Manufacturers have been studying this particular problem and as a result puncture-proof connections for high-altitude craft are already coming through.

Curtiss-Wright Corporation

erects new airplane manufacturing plant at Port Columbus, Ohio. Office and engineering sections air conditioned, factory mechanically ventilated, to make possible maximum output. Project designed by Albert Kahn Associated Architects and Engineers, Inc.

By M. A. JENSEN†

THE new airplane manufacturing plant located at Port Columbus, Ohio, is situated on an 85-acre site with buildings comprising the Administration, Engineering and Factory Group, Boiler House, Oil Storage and Service Garage.

The administration building is of two-story design with basement monolithic concrete construction with tile and buff colored face brick outer walls. The engineering building is of one-story structural steel framing construction with single member arc welded I-beam arches supporting the modified Mansard type of roof which permits a continuous run of sash on either side of each 50 ft bay, the glass being set at such an angle as to provide the maximum penetration of light.

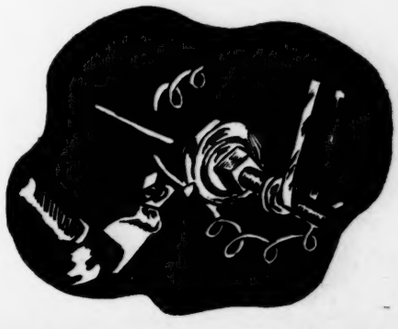
The factory building is of single story design with the exception of a basement area of 228,000 sq ft. This area houses the personnel quarters, hospital, executive garage, cafeteria, lunch rooms, coat and wash rooms, storage rooms and machine rooms for elevators, heating and ventilating equipment.

Manufacturing section has a height of 20 ft to the lower cord of the roof trusses while the final assembly has a height of 40 ft at a similar point.

The aforementioned buildings all have reinforced concrete roof sheathing insulated with 1 in. of granulated pressed cork and 3-ply composition roofing. All glass facing the sun is of a composition designed to reduce the transmission of solar heat rays to the minimum.

Air Conditioning

The Offices, Engineering Building, Cafeteria and Hospital sections comprising some 2,186,250 cu ft of space are completely air conditioned, approximately 738



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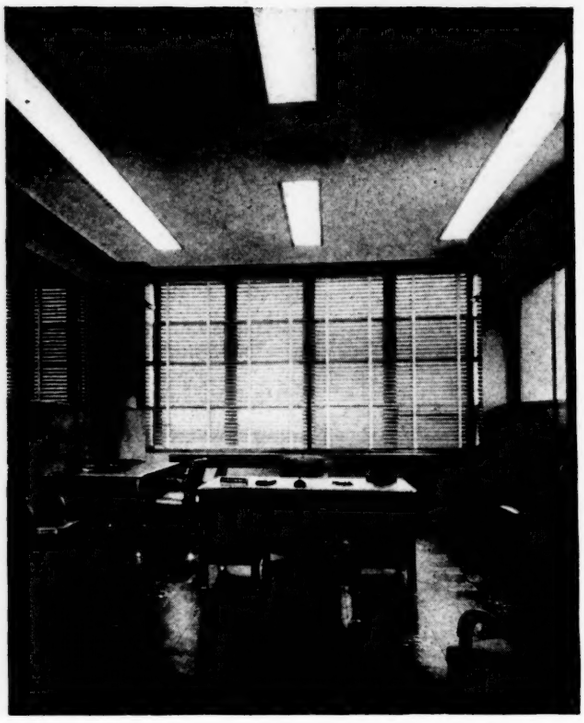
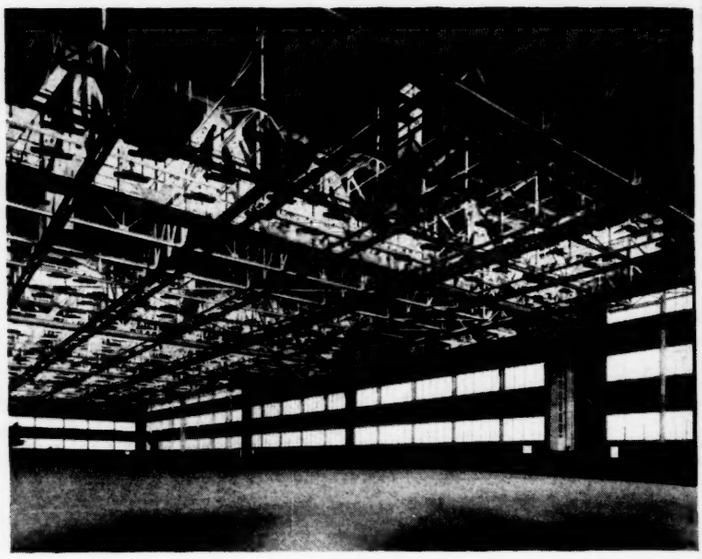




(Left) Typical office showing air conditioning outlet in ceiling. Heating is by means of forced circulation hot water. (Above) View of factory section before equipment was installed. Heating and ventilating system was designed with provisions for blackout operation.

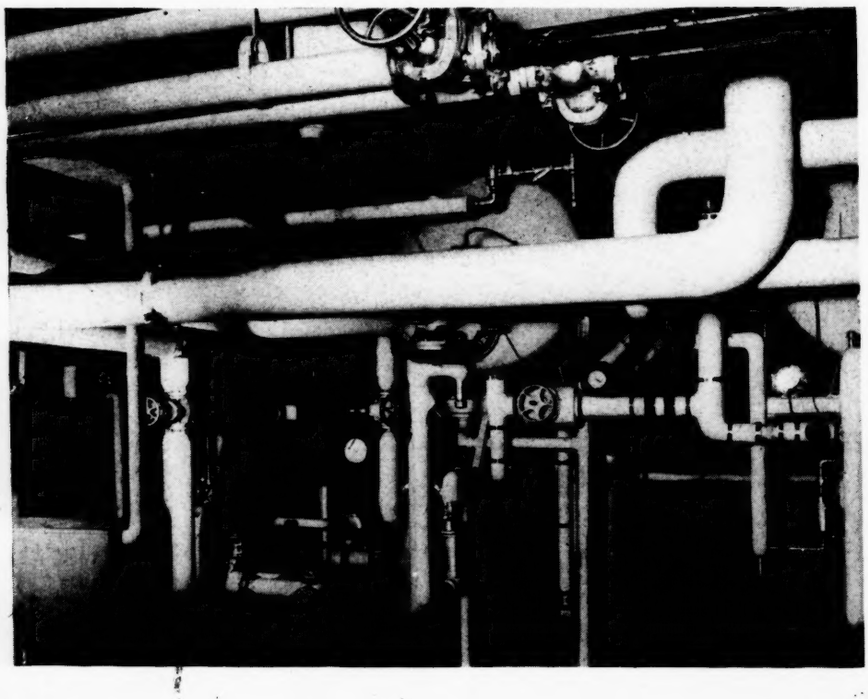
tons of refrigeration effect being required. Supplementing the supply system throughout the air conditioned area are 38 exhaust fans having a total capacity of 500,000 cfm. Various units are grouped and located in such a manner as to require minimum amount of distribution duct work, each group being located in isolated semi-fireproof rooms.

The air conditioning and ventilating system is divided into 12 independent systems having a total fan capacity of 345,100 cfm, the smallest of these being 1,800 cfm and the three largest, 48,000 cfm.

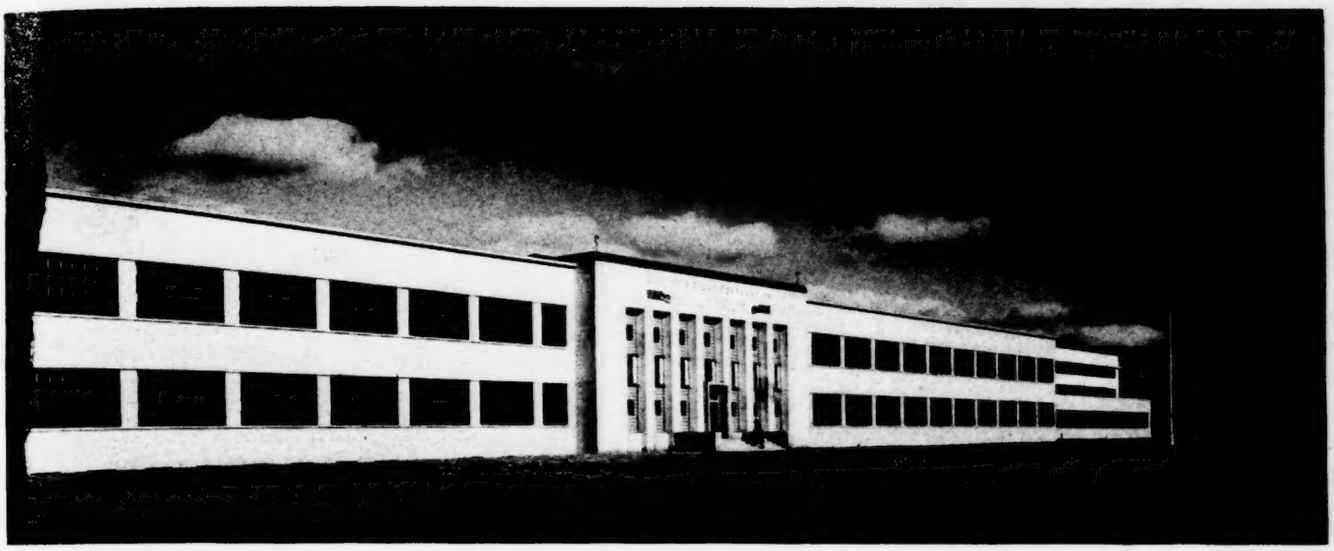
Primary air is drawn from the outside through louver openings in penthouses and brought down into the plenum chambers. The required quantity of fresh air is controlled by means of dampers which are positioned by means of a thermostat located in the fresh air duct resulting in closure of the same when outdoor temperatures reach either the maximum or minimum predetermined heating (normally 45F minimum and 85F maximum). The air then passes through continuous self-cleaning unit filters and from this point the air is conveyed through the usual housings in which are located tempering coils, then fin tube evaporating coils and the reheating coils.

These are of a particular design involving a tube within a tube, the steam being introduced from the perforated inner core through orifices from which it passes to the outer tube. In the latter the condensate flows back parallel to, and in contact with, the heated core, thus affording positive assurance against freezing and stratification.

Conditioned air is then drawn through the fans and delivered through the duct system to various rooms and discharged through directional grilles.



Forced hot water heating equipment serving the offices. Note that the instruments, heat exchanger, condensate drain traps and circulating pumps are in duplicate. Cabinet at lower left foreground is an air conditioner serving the executive dining room.



Administration building of Curtiss-Wright Corporation's Port Columbus plant. This building, as well as the engineering building, cafeteria and hospital sections are completely conditioned with a 738 ton air conditioning system.

Return air is removed at the floor line and delivered back to plenum chambers.

Compressor units are of the twin radial cylinder design employing Freon. Each unit is equipped with an individual shell and fin tube condenser and a heat exchanger.

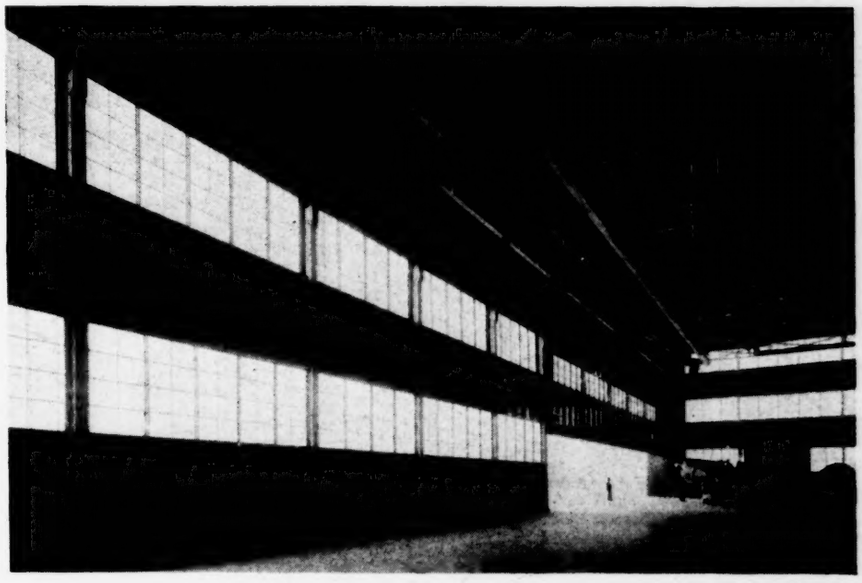
Cooling of the refrigerant is accomplished by means of water drawn from the distribution main which in turn is supplied by a 2000 gpm cooling tower situated adjacent to the Boiler House. This tower is guaranteed to cool the designated quantity of water from 95F to 85F at 78F wet bulb. Duplicate circulating pumps located in the boiler house basement maintain the necessary circulation in the system. An electro pneumatic control system is employed which acts directly on the solenoid operated expansion valve and indirectly on the unloading device of the compressors to maintain proper wet bulb temperature in delivery duct.

All circulating fans are driven by means of induction motors by multi V-belts and a choice of two speeds is obtained by electrical remote control.

Office Heating

During the winter months heating of the office portion, hospital and personnel section is accomplished by means of a forced circulation hot water system. Heating of the water is accomplished by means of heaters employing the combination of live and exhaust steam at approximately five pounds pressure. Control of this system is by an outdoor thermostat located on the roof of the office building and acting direct on the steam admission to heaters. Delivery of the heat to the various rooms is accomplished by concealed copper fin type convectors located under window sills. During the winter season the refrigeration compressors may, if desired, be shut down and the ventilation portion of this system is utilized and the steam supply to the heating coils zone controlled by means of duct-stats located at centralized points in the office. This then in reality forms a combination of a forced hot water heating system with hot blast ventilation acting as an auxiliary.

There are two lunch rooms comprising 120,000 cu ft each, and two locker and wash rooms comprising 180,000 cu ft each in the basement area. These are served by means of central exhaust systems which insure approximately six air changes per hour in the lunch rooms and four changes per hour in the locker rooms. Heating is supplied by means of a hot blast



View of portion of the factory section showing large doors which complicate the heating problem. The factory section is heated by downward discharging unit heaters located in the truss space.

A section of the general manager's office showing concealed type convectors used for heating.

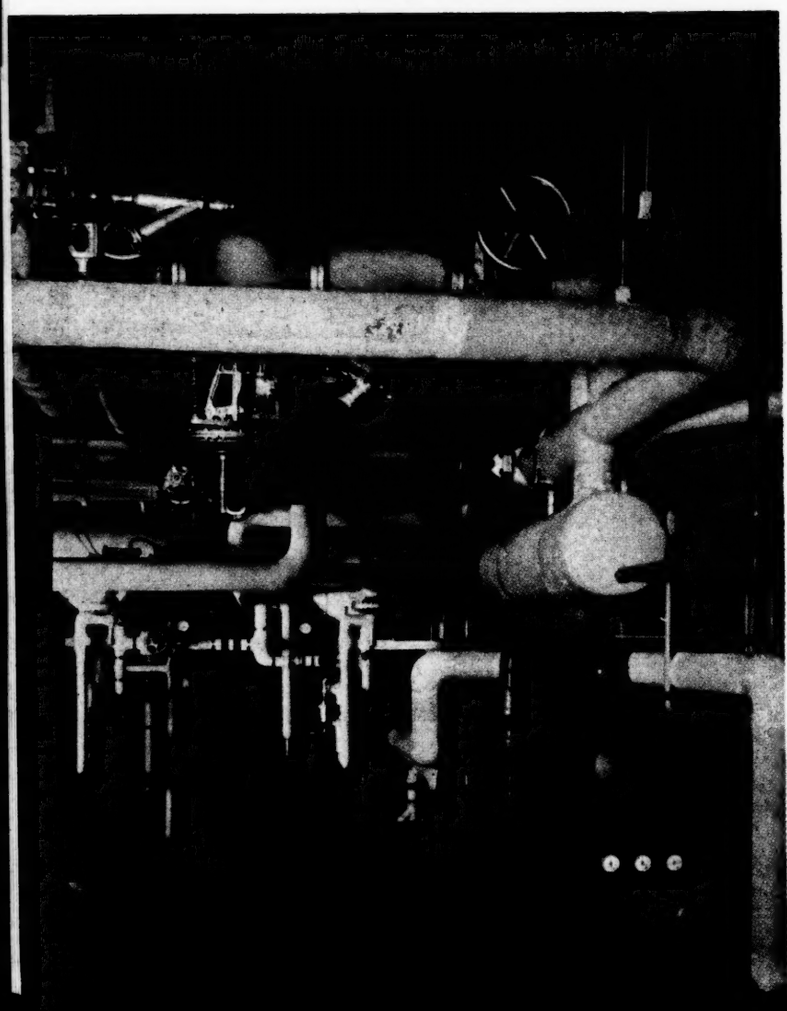
system in which all the air is taken from the outside.

It is planned to maintain an average dry bulb temperature of 80F and 55% relative humidity during the warm weather season. During the heating season a dry bulb temperature of 74F - 76F at 40% relative humidity will be maintained in order to avo'd frosting of the single thickness windows employed.

Plant Ventilation and Heating

Although blackout operation is quite unlikely to be required, far sighted officials representing the United States Army and Navy, Curtiss-Wright Corporation and Albert Kahn Associated Engineers and Architects were disinclined to gamble against possibilities of the future. Year around ventilation is therefore completely independent of all doors and windows.

A typical refrigeration compressor unit used for conditioning office and engineering building. At the ceiling can be seen a reducing valve station in the steam supply line. Note the heat exchangers installed above the condenser of the compressor units. Equipment in the background is for heating service hot water.



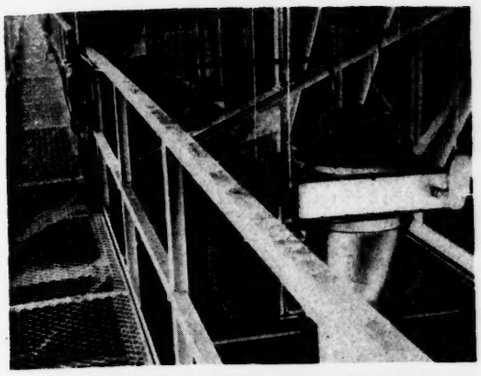
A total of 420,000 cfm is exhausted from the building continuously due to process requirements. During the heating season this will be balanced by means of a series of suitably distributed unit heaters suspended under the roof which draw the requisite quantity of air from without and discharge at a point approximately 5 ft below the lower chord of the roof trusses through directional grills. Temperature control of these units is by means of a thermostat located out of the direct path of the discharge which positions a damper in the by pass adjacent to the fin coils within the unit heater casing. These units are electrically interlocked in groups with the corresponding group of process exhaust fans in such a manner as to insure positive starting of inter-dependent groups and vice versa.

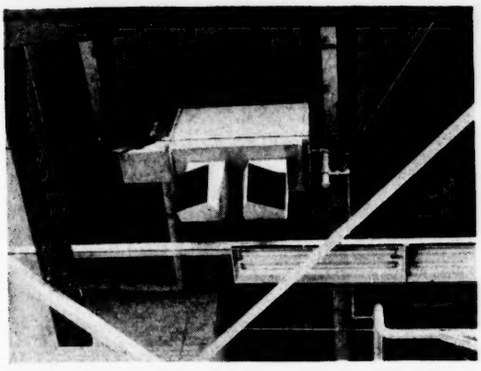
The required additional heat is supplied by means of a series of suitably distributed recirculating unit heaters which in most cases are suspended just below the line of the lower chords of the roof trusses. These units discharge at an angle of approximately 45° through two nozzles installed in a revolving head which are rotated at approximately one rpm. This together with the adjustable deflecting shields which are installed at the outlet of each nozzle effectively prevents the occurrence of unpleasant draft effects. Normal operation of units is under control of individual thermostats located on roof columns accessible from the floor. Additional control which permits an entire row (transverse of building) to be switched from normal to *night* or *holiday* operation (15F below normal of 75F and vice versa) by means of thermo switch located on the wall at the end of each row of heaters. This affords a simple and speedy method of reducing the steam consumption of all heaters when not required for normal operation.

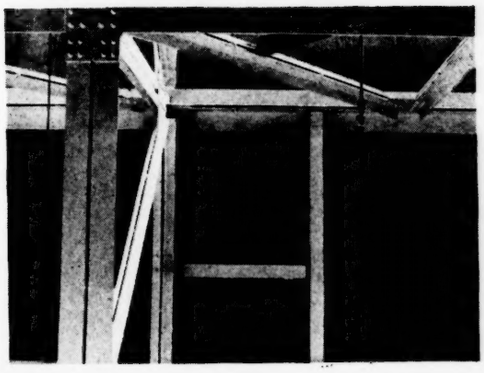
Additional ventilation during the non-heating season is provided through the employment of a series of suitably distributed propeller type exhaust fans installed in openings in the roof and discharging to the atmosphere through a light and weather excluding hood. A total of 1,690,000 cfm of air is exhausted by means of aforementioned fans which is balanced by series of suitably distributed propeller type supply fans installed in a manner similar to the exhaust fans with exception that discharge of each is directed by means of a duct to a point extending approximately 5 ft below the lower chord of the roof trusses. Distribution is afforded through the employment of directional grills at the point of discharge.

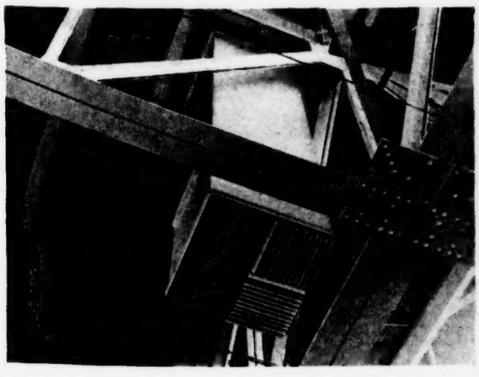
Condensate from all high points gravitates direct to boiler house. Condensate from low points is collected in receivers at suitably located points and then delivered to main condensate return line by means of float controlled pumps.

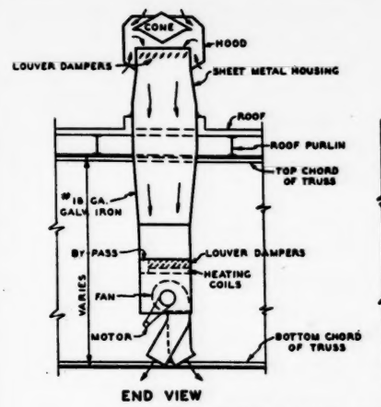
Steam is supplied from the boiler house located adjacent to the factory building. The three main steam generating units are of the 3 drum bent tube type with water cooled dry hopper bottom furnace. Each unit is



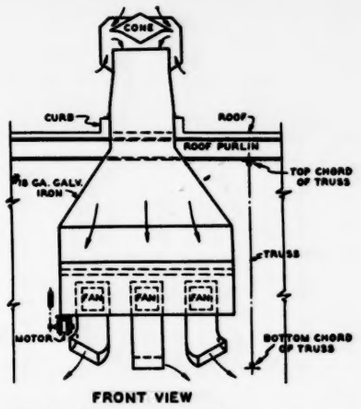






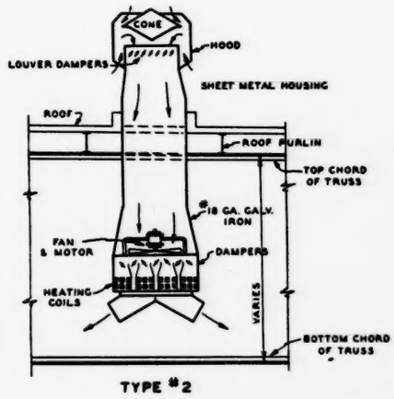


END VIEW

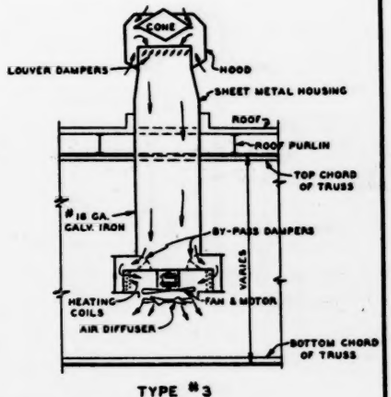


FRONT VIEW

WINTER SUPPLY UNIT TYPE #1 (BLOWER TYPE)

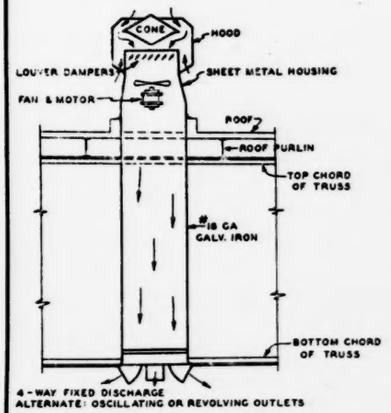


TYPE #2

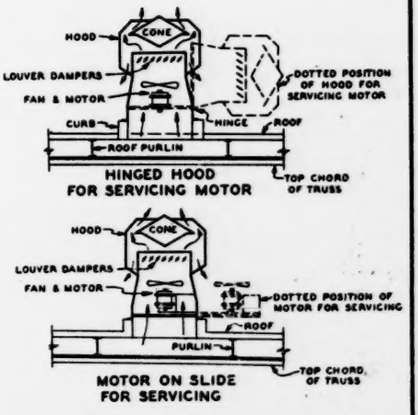


TYPE #3

WINTER SUPPLY UNITS (PROPELLER TYPE)



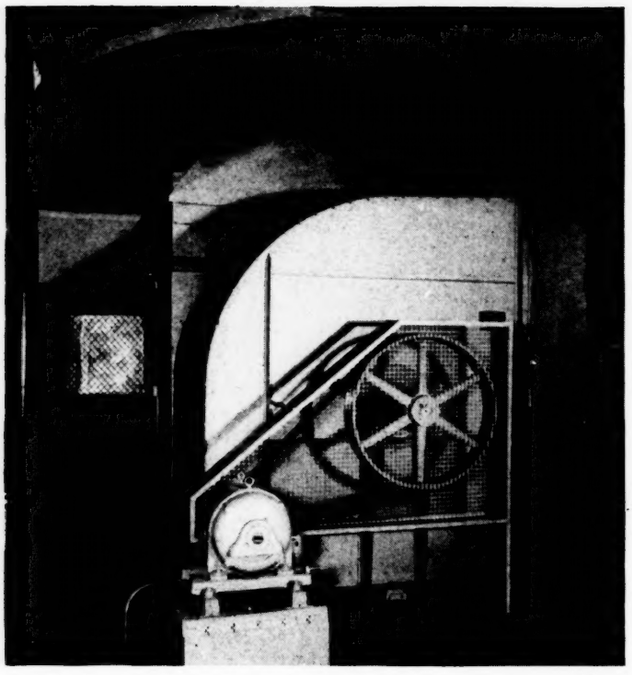
SUMMER SUPPLY UNIT

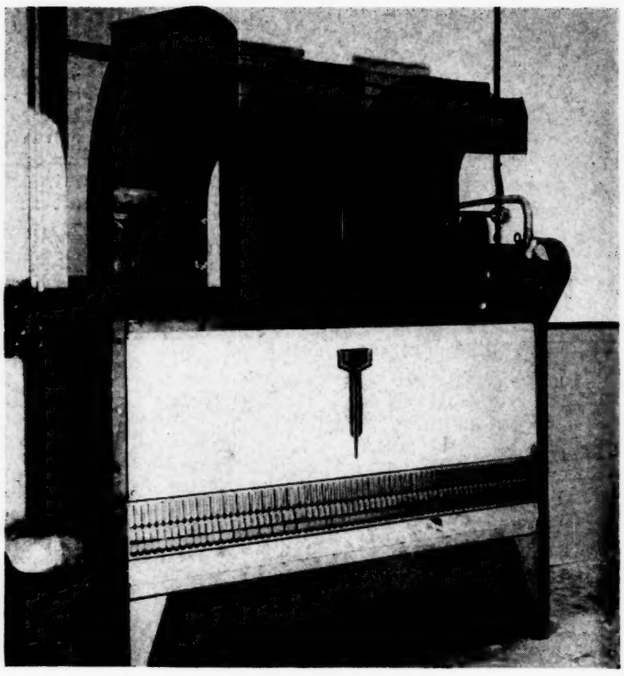


HINGED HOOD FOR SERVICING MOTOR

MOTOR ON SLIDE FOR SERVICING

EXHAUST UNIT





(Left) A typical exhaust fan for the air conditioning area. (Right) One of the recirculating floor type unit heaters used for heating in the factory section.

capable of delivering 75,000 lb of dry saturated steam per hour at 175 lb per sq in. gauge. Firing is by means of pulverized fuel with means of employing fuel oil during starting, or at ratings below 25,000 lb per hour ratings. A standby unit of the same general design is provided for use during non-heating season. This unit employs a traveling grate over feed stoker and has an ultimate capacity of 25,000 lb per hour.

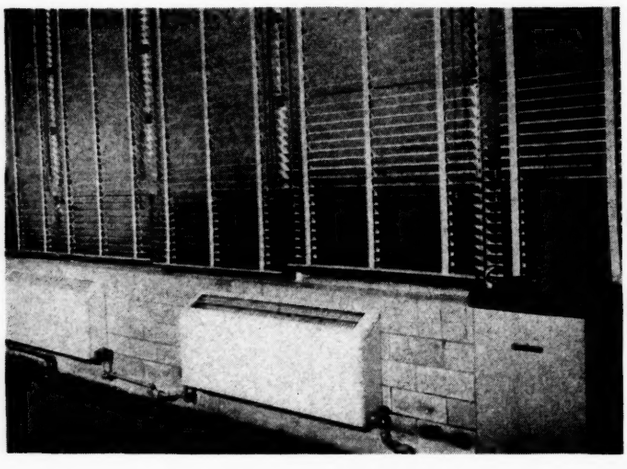
All steam generating units are provided with forced draft and induced draft fans, dust collectors and a complete complement of instruments, meters and controllers for control, indicating, recording and integrating of all combustion and steaming operations.

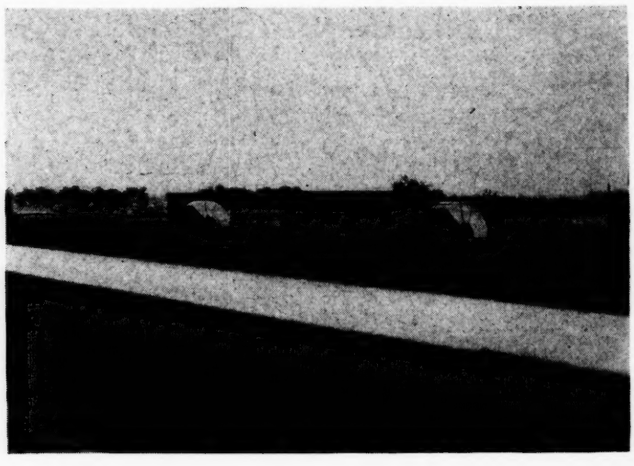
Coal is received via rail and may be dumped into either of two track hoppers. From one the coal is transported through a series of conveyors and elevators to the 600 ton bunker extending the full length of and over the firing aisle. The second hopper delivers the coal to an outside storage pile.

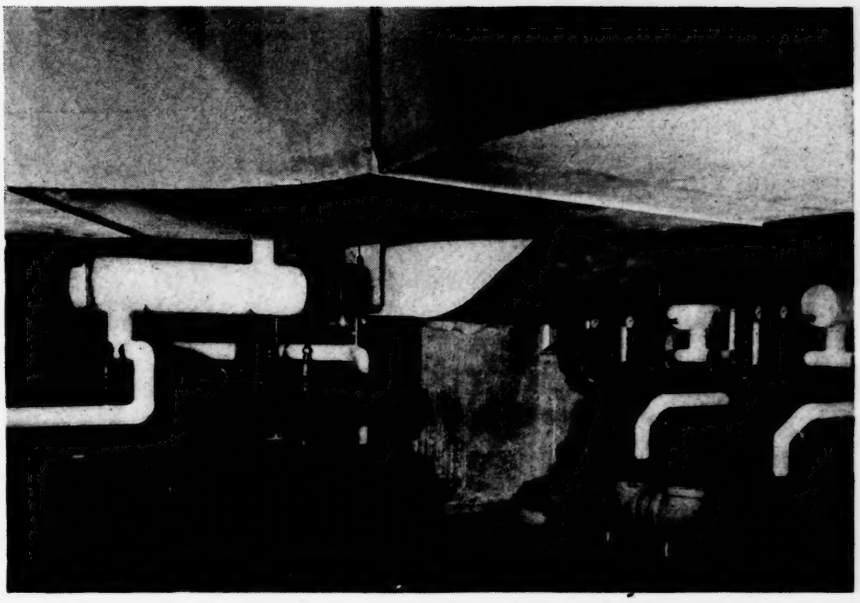
Fuel oil is received via rail or truck and is conveyed by gravity direct to a series of underground storage tanks. From this point same is pumped through a system of strainers and heaters direct to the burners as needed. Heating coils in the storage tanks and provisions for a return flow of heated oil from the heaters and burners facilitates the use of heavy oils during cold weather.

Columbus city water at approximately 4 grains per gallon hardness is utilized as boiler feed make up water. An acid treatment is utilized to reduce the alkalinity to a point desired for passing same through a battery of zeolite softeners. Condensate is pumped from the main receiving tank to deaerating heater. The desired quantity of make up water is supplied to this heater under separate control. Chemicals covering the final control of the small amount of remaining undissolved solids or suspended matter are introduced either into the heater or direct to the individual boiler drums

(Left) Heat loss of the engineering building is taken care of by wall mounted convectors using forced hot water. (Right) Portion of the administration building roof showing air intake penthouse and air discharge ducts.







Typical refrigeration compressor units serving the engineering building. Note the duplex arrangement of the cylinder groups with driving motor in center.

as required from information gained from daily analyses of raw, treated and boiler water. Boiler blow down is controlled by a continuous blow down system in which a portion of the heat is recovered in a flash chamber and diverted to the 5 lb per sq in. exhaust system and the balance diverted through a heat exchanger on its path to the sewer. Boiler feed make up water flows through this exchange before entering the heater.

A fairly good heat balance is obtained by utilization of two independent systems. The first utilizes steam exhausted at 5 lb per sq in. gauge from turbines driving various pumps, forced draft and induced fans required in the boiler house. The steam thus released is diverted to the boiler feed water heater. A choice of dual turbine and motor drive or individual turbine or motor drive in connection with the various auxiliary units affords the necessary degree of control in the release of steam in this system.

The remaining system comprises a series of piping originating in the boiler house in the form of a 12 in. welded main and extending therefrom through an underground passage into one end of the factory building and thence overhead adjacent to an outer wall to the extreme end of same, a total distance of some 2000 ft. Size of this line is reduced progressively. A combination of slip joints and U-bends permits the necessary expansion and contraction. This main supplies all the steam used in the factory and auxiliary buildings.

Distribution is effected by means of a number of lines extending radially from the main to the various points of usage.

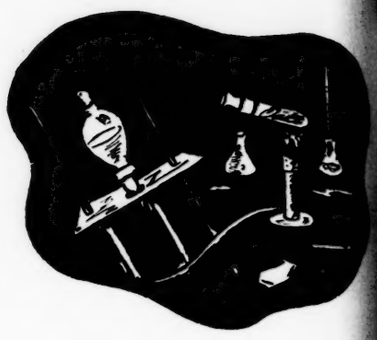
Exhaust steam is supplied to this line from two 3000 cfm steam driven air compressors located in the boiler house. Each of these units delivers approximately 12,500 lb of steam per hour at 30 lb per sq in. gauge at full load. An additional motor driven compressor of similar capacity is utilized to effect a partial degree of balance to the system.

Steam at boiler pressure is required to effect the final degree of balance and to augment the supply of steam during periods of heavy demand in the main low pressure supply and distribution system. This is effected by means of a 12 in. main originating at the boilers and having its terminus at point approximately 1000 ft from its entrance to the factory building. Connection into the low pressure system is made at three points, namely, in the boiler house through the means of an 8 in. pilot operated regulating valve, an 8 in. direct operated regulating valve at the point of entrance of steam mains to factory building and at the point of terminus of the high pressure main 1000 ft farther on.

During season of heavy steam demand both high and low pressure steam supply mains are utilized in the following manner, namely, both compressors operate exhausting to low pressure main. Regulating valve at boiler house remains closed. Regulating valve at near end of factory operates to maintain system pressure at 30 lb per sq in. Regulating valve at far end of factory operates to supply any deficiency in pressure below 27 lb per sq in., this being the allowable pressure drop between points in question.

During the season of light steam demand, the high pressure steam main is shut off at its point of exit from boiler house. One steam driven compressor operates and exhausts into low pressure main, and any deficiency in pressure is supplied through the medium of the pressure regulating valve in the boiler room.

Industrial Tape Corp.



heats its new building with one of the first high temperature hot water district heating systems in the country. Air conditioning helps reduce losses in cellophane tape manufacturing operations.

By JOSEPH F. KERN, JR.†

THE new plant of the Industrial Tape Corporation is of interest to heating and air conditioning engineers not only because it forms one part of a highly modern industrial community now being built by Johnson & Johnson, its parent company, but also because it is heated by a high temperature hot water district heating system—one of the first systems of its type in this country.

The Johnson & Johnson development is located on a 250-acre tract of rolling farm land on the outskirts of New Brunswick, New Jersey. At the present time there are seven buildings completed representing about 30% of the final program. These include the Industrial Tape building, Personal Products office, garage and factory building, a boiler house and the Ligature Laboratories building. Space is provided for at least five future buildings.

At the present time only the Industrial Tape building and the Personal Products factory building are served by the boiler plant. Provisions have been made, however, for adding the proposed buildings and some of the present buildings to the district hot water lines and the boiler house has been designed so that it will be able to carry the future load.

Hot Water System

The heating system is known as the Supertherm System and was installed by the J. O. Ross Engineering Corporation.

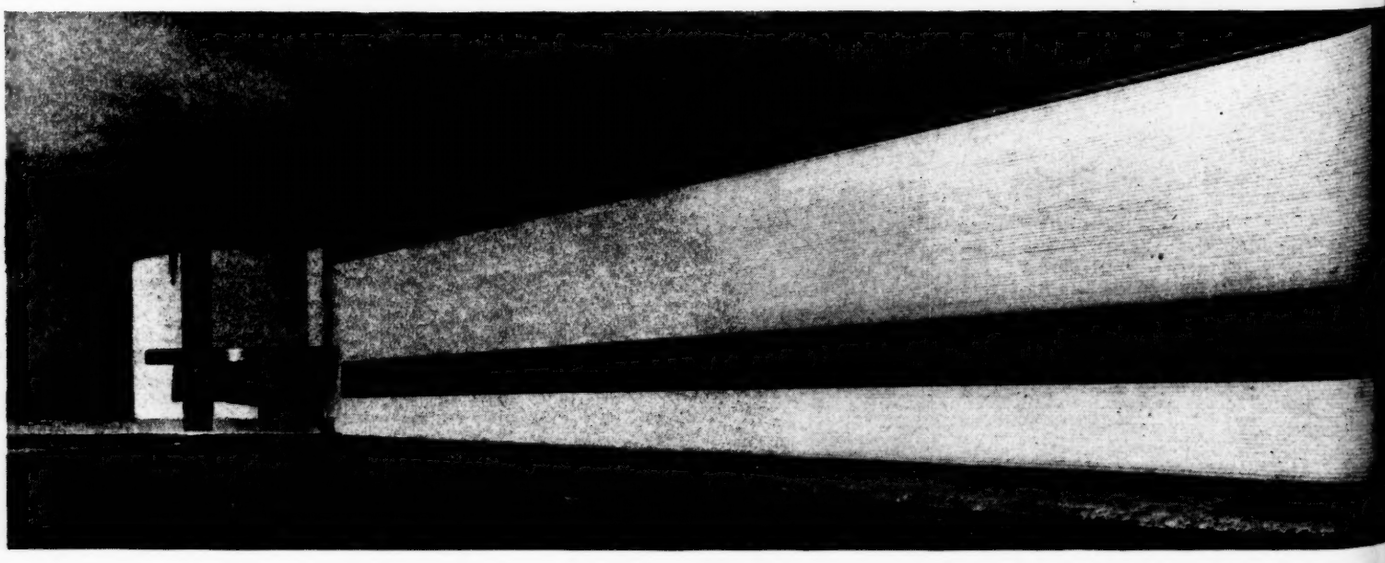
Basically, the Supertherm System is a high pressure forced circulation hot water heating system. The water is drawn at steam saturation temperature (350 - 400F) from a standard make industrial boiler and is circulated through a completely closed system by means of specially designed pumps. The temperature drop is large when compared with the drop in the usual hot water heating system—that is, it is in the order of 100F rather than 10 to 20F. There are no traps, pressure reducers or separators used and the fittings and mains are welded. Because the system is a closed system very little makeup water is required so that in most cases a water treating plant is not necessary. Because flash losses and other steam losses are eliminated operating costs of this system are said to be lower than for conventional steam systems.

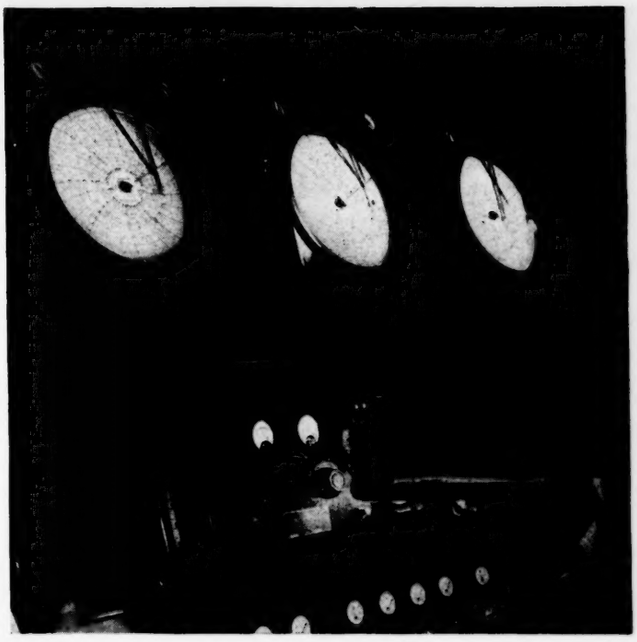
Boiler House

The boiler house is located about 1000 ft from the Southeast end of the 250-acre plot, about 300 ft from the Personal Products building and three quarters of a mile from the Industrial Tape building. Its level is slightly below the level of the Personal Products building and about 60 ft below the level of the Industrial Tape building.

The boiler plant is equipped with one 650 hp Erie City bent tube boiler and there is a space for a future boiler of the same size. The only changes made in the boiler were the installation of a hot water supply and return connection in the boiler drums and the main-

†Associate Editor, HEATING AND VENTILATING.





tenance of a higher than usual water level. The boiler is equipped with a Todd oil burning burner designed to operate at 200% of the boiler rating. It operates at approximately 180 lb pressure and some steam is taken off to meet the needs of some of the auxiliary equipment such as oil pumps, soot blowers, and fire pumps. This ability to supply both steam and hot water from the same boiler is one advantage of this type of system.

Hot Water Distribution

Due to the location of the buildings and to the distances involved two zones were provided in the hot water distribution system. The first zone serves the Personal Products buildings and is also designed to take care of the future buildings in this area. Because the distances are short the pumps circulating water operate at a relatively low head. The zone serving the Industrial Tape building, on the other hand, is equipped with pumps operating under a higher head because of the greater distances involved.

Underground Distribution

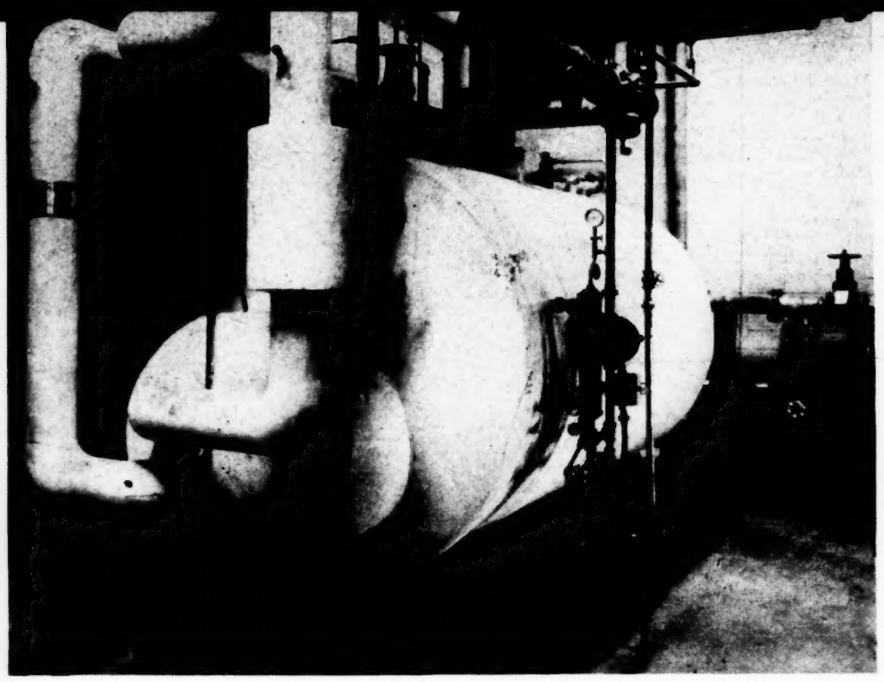
The underground distribution system is unusual in that it is part tunnel and part tile conduit. The reason for this is that the Public Service Corporation of New Jersey's right-of-way runs across the property and in order to comply with their requirements it was necessary to run underground tile conduit under the right-of-way.

Therefore from the boiler house to the Personal Products building and from there to the Public Service right-of-way the lines are carried in tunnels. From this point tile conduits carry the lines beneath the Public Service right-of-way, to and under Highway No. 1 and thence to the Industrial Tape building. Where the tile conduit leaves the right-of-way there is an underground distribution room where blanked off branches are taken off to provide for the future buildings.

Industrial Tape Building

The Industrial Tape plant building is a modern type industrial building faced with buff colored brick and trimmed with a terra cotta tile. The plant is of one-story construction except for a mezzanine floor which houses lockers, storerooms and air conditioning and service hot water equipment.

Along three sides of the building are long strip windows approximately 3 ft high. These windows are of plate glass with stainless steel trim with lucite mullions which give the effect of a continuous plate glass window.



Closeup of hot water fired steam generating unit which supplies 4000 to 5000 lb of steam to the solvent recovery system. The generator is a Patterson Kelley heat exchanger which consists of submerged high temperature hot water heating coils in a storage tank. Brown pressure controller regulates amount of hot water to the coils while a McAlear automatic water feeder controls make-up water.

The building is approximately 230 ft long and 176 ft wide with a height in the factory section of 14 ft 2 in. to the roof trusses and 18 ft 6 in. to the roof.

History

The Industrial Tape Corporation is a comparatively new company having been incorporated in 1937 although its beginnings date back to the early 1920's. About that time Johnson & Johnson noticed that large amounts of surgical tape were being sold by a drug outlet in Detroit. Upon investigation they found that automobile manufacturers were using this sterile surgical tape for masking automobile parts during spray painting operations. Shortly after this Johnson & Johnson developed a line of cloth tapes for paint masking and this line of tapes formed the original line of the Industrial Tape Corporation. At the present time the company is making about 26 kinds of adhesive tape which goes into approximately 30 industries.

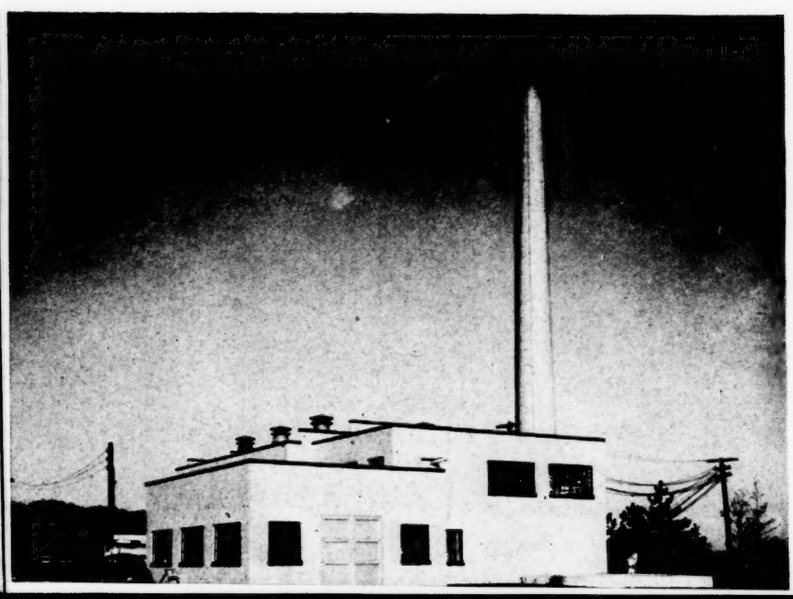
The manufacture of practically all adhesive tapes starts with raw rubber. This rubber is put into a machine which pulverizes it and is mixed with other chemicals and a solvent, such as toluol to liquefy it. It is then pumped by pressure into adhesive coating machines, where it is placed on the tape. The tape then goes through a dryer before it is rolled and cut to proper size.

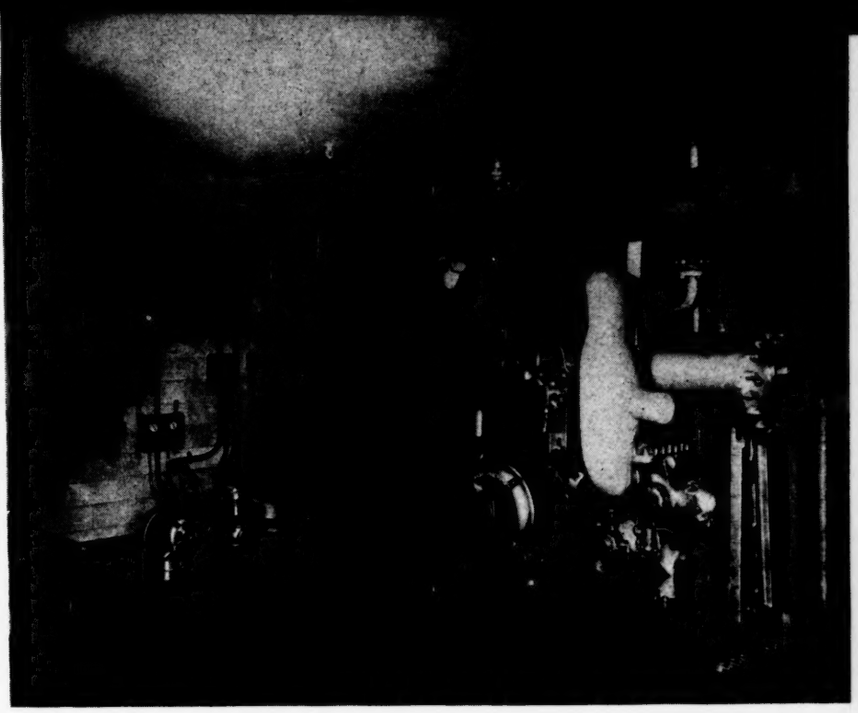
Heating System

Both the space and process heating requirements of the plant are met by the high pressure hot water system. The hot water mains enter the building in the southwest corner, are carried up to the roof truss spaces and are run through these spaces to the various heating units. Both process and space heating equipment is attached directly to the main, and, in general, the hot water returns follow the supply mains. The mains are sized so that they can supply 16 million Btu per hr which is estimated to be equal to the maximum future demand.

A considerable amount of heat is required for process heating. This heat is employed in the tunnel dryers, mixers, solvent recovery unit, and other equipment. In the tunnel dryers the drying is done by means of heated air which is distributed by fans to the tunnel from the high temperature hot water heating coils. In all, about 13 million Btu per hr can be supplied by the heating system to meet both the present and future process needs.

(Left) Boiler house supplies high temperature hot water to both Industrial Tape Corporation and The Personal Products Corporation buildings. Boiler plant is equipped with a 650 hp Erie City bent tube boiler and a Todd oil burner. (Right) One of the seven large Buffalo Forge unit heaters used for heating the factory area. Unit heaters are equipped with Aerofin coils designed especially for use with high temperature hot water.





Two York refrigeration units which supply refrigerant to the air cooling coils. Large unit at right supplies refrigerant to the office and laboratory conditioning systems while small unit supplies refrigerant to the system which conditions the cellophane storage room.

The various pieces of process equipment are connected in parallel across the heating mains and the flow of water is controlled by automatic valves.

Hot Water Fired Steam Generator

Large amounts of solvents are used in the manufacture of the adhesive tapes and a complete solvent recovery system was installed to reclaim as much of the solvent as possible. This recovery plant requires between 4000 to 5000 lb of steam per hr.

Since the plant was about three quarters of a mile away from the boiler house it was not considered desirable to supply steam directly from the boiler. Therefore a hot water fired steam generating unit was installed.

The generator is a Patterson-Kelley heat exchanger which consists of submerged high temperature hot water heating coils in a storage tank. The tank acts as a boiler for generating approximately 5000 lb of steam per hr at 30 lb pressure. Steam generation is regulated by an air operated Brown pressure controller which controls the amount of hot water flowing to the coils. The steam condensate is not returned due to contamination and cold city water is used for makeup. A standard automatic feed water hookup is used for supplying the makeup water to the tank. The water level in the heat exchanger is maintained constant by a float control which regulates the operation of the pump.

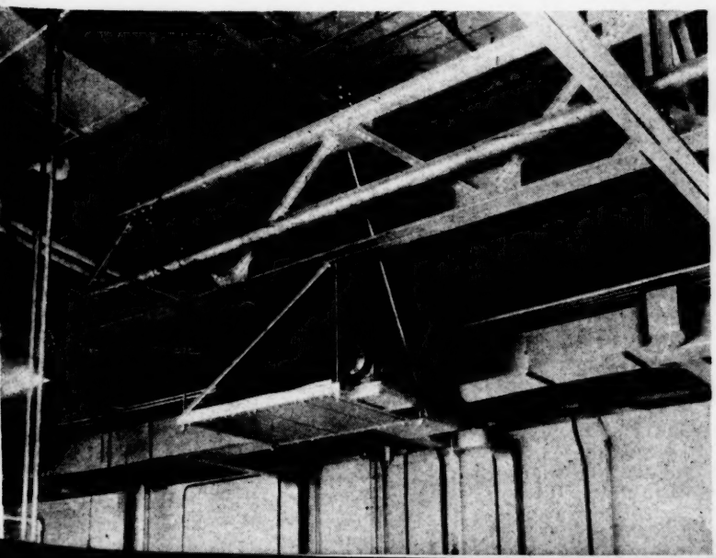
The dimensions of the heater and the capacity are equivalent to those of a 150 hp boiler. About 5,000,000 Btu per hr is supplied to this heat exchanger.

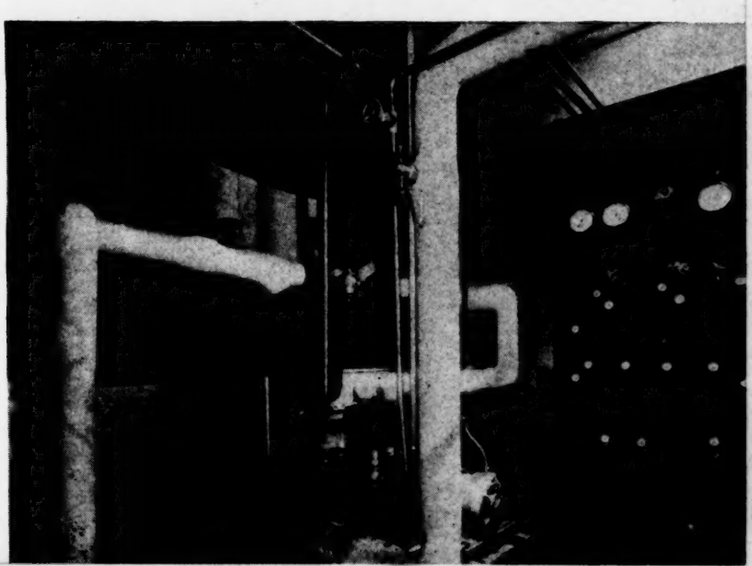
In operation the solvent recovery system requires large amounts of steam for relatively short periods. Due to the large amount of heat stored in the hot water it is possible to supply this steam without any appreciable temperature drop in the hot water supply system.

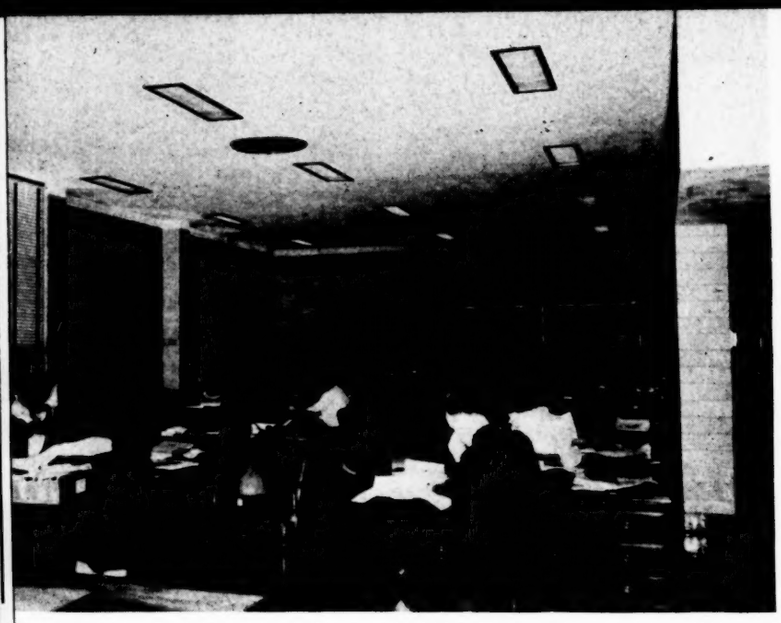
Service Hot Water

A hot water generator is provided on the mezzanine for heating the service hot water for showers and for other washing purposes. This generator consists of a high temperature hot water submerged coil in a storage tank. Automatic control is provided to regulate the amounts of hot water flowing through the coil so as to maintain a service water temperature of approximately 150F.

(Left) Closeup of the exhaust fan which is used for exhausting air from the mixing room. A special exhaust system is installed in this room to remove any fumes which may be given off during the mixing operation. (Right) Closeup of the Buffalo Forge air conditioning unit which supplies conditioned air to the laboratory. This unit is equipped with Sporlan refrigerant expansion valves, Powers controls and Owens-Corning Dust-Stop filters. At the right can be seen Powers regulator control board which controls the operation of the heating and air conditioning system in the plant.







General offices showing Anemostat ceiling diffuser which supplies heated and conditioned air. All of the heat for the office is supplied by Aerofin coils in the air conditioning system.

Heating

The manufacturing section of the plant is heated by seven large unit heaters. These unit heaters were made by Buffalo Forge and have special coils designed for high pressure hot water. Five of the unit heaters have a capacity of 331,000 Btu per hr and two have a capacity of 275,000 Btu per hr. A small unit heater has also been provided to take care of the heat loss of the machine shop.

Since the unit heater coils are connected in parallel on the mains they are equipped with hand valves to balance the hot water flow. During the heating season the hot water flows through the unit heaters continuously and the fans also operate continuously. Thus there is a continuous circulation of air in the plant at all times. Automatic bypass dampers regulate the amount of air flowing through the heating coils. The automatic dampers are in turn controlled by thermostats.

The mezzanine, including the locker rooms, is heated by eleven convector type radiators with a total heat release of approximately 100,000 Btu per hr. These convector radiators are arranged in a reverse loop system so that they are automatically balanced.

The heating of the office and laboratory spaces is accomplished by hot water Aerofin coils in the air conditioning units. Approximately 900,000 Btu per hr can be supplied by the heating mains to the air conditioning units.

Air Conditioning

Air conditioning is required in two phases of the manufacturing processes, and is also provided in the laboratories and offices.

In the manufacture of the cellophane tape air conditioning is required in the tape storage room and in the cellophane cutting room.

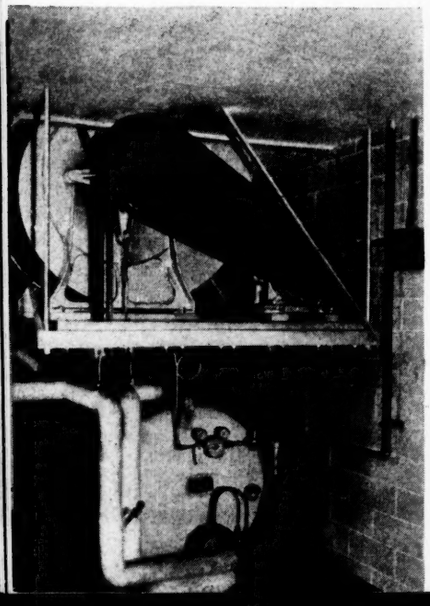
Office Air Conditioning

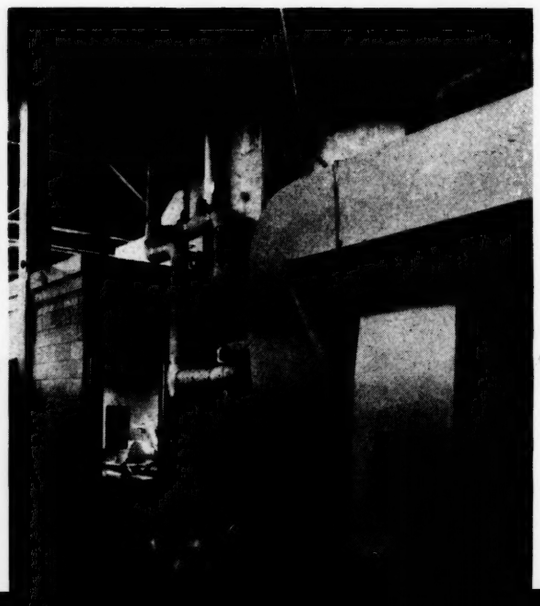
The office section is equipped with a 5 zone air conditioning system which supplies both heated and cooled air to the office space. The system has a capacity of 9,500 cfm and is equipped with a 30 hp York freon water cooling condensing unit. All of the heat required to warm the office space during the winter is supplied by high temperature hot water coils in the air conditioning system.

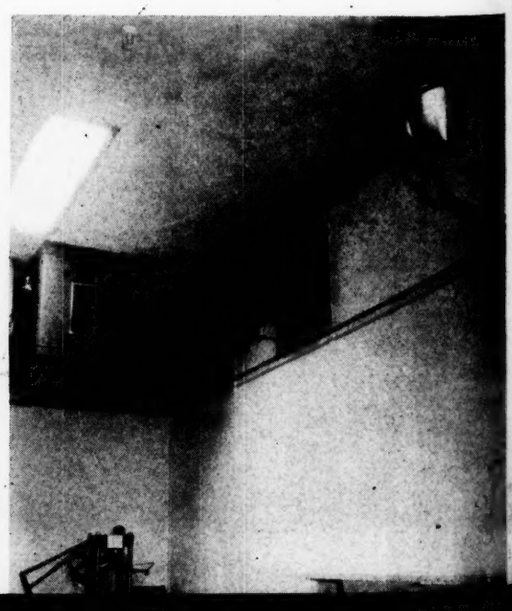
The laboratory system supplies 4250 cu ft per minute of conditioned air to the laboratory. As in the office section the heating load is carried by a high temperature hot water heating coil in the conditioning system. Anemostat air outlets are used in all the offices and laboratories for distributing the air.

The air conditioning and heating system was installed in this plant by Blocker Air Conditioning Corporation, Newark, N. J., while the Supertherm high temperature hot water system was installed by J. O. Ross Engineering Corporation, New York. The consulting engineers were R. G. and W. M. Cory, New York.

(Left) At the bottom of this picture is a Patterson-Kelley hot water generator which generates service hot water from high temperature hot water. Taylor reverse acting controller controls the operation of the unit. Above is a Buffalo Forge exhaust fan for exhausting air from toilet and locker rooms. (Center) York compressor and air conditioning unit which supplies conditioned air to the cellophane tape cutting room in the background. Pipes are insulated with Johns Manville pre-shrunk wool felt. (Right) View in testing Laboratory showing McQuay air conditioning unit and a Powers controller.







ABSTRACTS of Current Papers, Books and Pamphlets

Weather

In pursuing his art the heating and ventilating engineer finds many side streets diverging from the main thoroughfare and which he may be highly interested and diverted in exploring. Thermodynamics is one of these, especially for those whose air conditioning work leads them rather deeply into this subject. Another is the weather, since it is due to the extremes, the vagaries and the characteristics of weather and climate that a great portion of heating, ventilating and air conditioning is necessary.

For those interested in the weather, professionally or as a hobby, an unusual, comprehensive and rather striking publication has just made its appearance. This is the volume entitled "Climate and Man," the sixth in a series of yearbooks of the Department of Agriculture and which replaces the old yearbook which attempted to cover all phases of agriculture. Previous books in this series have dealt with plants, soils, food, and in 1940, farmers in a changing world. Since the United States Weather Bureau is a part of the Department of Agriculture, the 1941 yearbook is devoted entirely to climate and its relationship to human beings.

Inasmuch as this volume is one of 1248 pages it is hardly possible in a short space adequately to summarize all of the fascinating information which appears in it. In a general way, though, the book consists of five parts preceded by an introduction or summary which gives a birdseye view of that which follows. Each of the five parts is sub-divided into chapters. The first part, Climate as a World Influence, includes a section on the How and Why of Weather Knowledge by F. W. Reichelderfer, director of the United States Weather Bureau. The second part, Climate and Agricultural Settlement, not only adequately covers the climate of the United States but subjects such as The Colonization of Northern Lands by Stefansson, as well; a chapter on Comfort and Disease in Relation to Climate, by Joseph Hirsh, formerly of the United States Public Health Service; and one on Health in Tropical Climates by Robert G. Stone of the Blue Hill Meteorological Observatory of Harvard University. The third part is entitled Climate and the Farmer and the effect of weather variables on different crops is discussed by a specialist in each of the major crops. A fourth part, the scientific approach to Weather and Climate, includes a chapter on flood Hazards and Flood Control and three chapters on How the Daily Forecast is Made, The Scientific Basis of Modern Meteorology and Amateur Forecasting from Cloud Formation.

The fifth part of the book is primarily statistical in character, giving a climatic summary with tables, maps, and discussion of the weather in each state; a series of 46 maps under the heading Climates of the United States and including, apparently, but brought up to date, all of the maps formerly appearing in the Atlas of Agriculture. These data are preceded by a chapter on Climate and Weather Data for the United States by J. B. Kincer, Principal Meteorologist and Chief of the Division of Climate and Crop Weather of the Weather Bureau and who, presumably, is responsible for the beautiful series of maps mentioned above.

Many of the chapters in this publication will make interesting reading at any time but the book's principal value may lie in its use as a reference work.

The committee responsible for this publication is to be highly congratulated for its painstaking work, for the discrimination and ability they displayed in selecting authors for the various chapters, and also for the arrangement, scope, and attention to details—one of which is the attractive end papers on The Pattern of World Agriculture.

The American Technical Society has just issued another in a series of reference books entitled "Flight—Meteorology and Aircraft Instruments" in which appear in simple terms, profusely illustrated, chapters on The Atmosphere, Atmospheric Moisture and Weather Forecasting, the Weather Map, and similar information of particular interest to those interested in the subject from the standpoint of aircraft. The chapter on the airway weather service is astonishing to anyone not familiar with the extent to which the Weather Bureau had broadened its activities to supply vital information for the airways. Other chapters include those on Aerial Photography, Aviation Radio and Aircraft Instruments.

[*"Climate and Man"—1941 Yearbook of Agriculture. Cloth bound; 6 x 9 in. 1248 pages. For sale by the Superintendent of Documents, Washington, D. C. Price, $1.75.*]

[*"Flight—Meteorology and Aircraft Instruments" by Capt. Bailey Wright, W. E. Dyer and Rex Martin. Published by American Technical Society, Chicago, Ill. Cloth bound; 6 x 9 in.; 348 pages. Price, $3.25*].

BRIEF REVIEWS

RADIATORS. The simplified practice recommendation for large-tube cast-iron radiators adopted October 1 by the Department of Commerce. [*"Large-Tube Cast-Iron Radiators" — Simplified Practice Recommendation R174-41. Published by U. S. Department of Commerce, National Bureau of Standards, Washington, D. C. Paper cover; 6 x 9 in.; 13 pages. Price, 10 cents.*]

METAL LAYOUT. An attractively printed and bound book on sheet metal layout with special reference to air conditioning, heating and ventilating. The author is an instructor of sheet metal apprentices at the Washburne Trade School in Chicago and the material in the book indicates that the author not only knows his subject but knows how to present it. [*"Air Conditioning Metal Layout," by Joseph J. Kaberlein. Published by The Bruce Publishing Company, Milwaukee, Wis. Cloth bound; 6¼ x 9¼ in.; 308 pages. Price, $3.75.*]

FREON. A comprehensive report on freon refrigerants as prepared by the Air Conditioning and Refrigeration Industry Committee for OPM. Contains the following: a general review of the characteristics of refrigerants required by the air conditioning and refrigeration industry; a summary of codes and standards; technical considerations pertaining to the application of refrigerants; results of a questionnaire to determine the extent of possible substitutes for freon; and an analysis of the amount of freon required in the air conditioning and refrigeration industry in 1942. [*"Report on Freon Refrigerants." Published by Air Conditioning and Refrigeration Industry Committee. Prepared for OPM.*]

THERMODYNAMICS. The object of this book is to give a simple and rigorous exposition of the various laws of thermodynamics. It is prepared for use as a college textbook and covers its subject in a comprehensive manner. [*"Thermodynamics," by Joseph H. Keenan. Published by John Wiley & Sons, Inc., New York. Cloth bound; 6x9 in.; 499 pages. Price, $4.50.*]

INDUSTRIAL HYGIENE. A report presented before the sixth annual meeting of the Industrial Hygiene Foundation of America, Inc., and dealing with this problem with particular emphasis on defense industries. Particularly interesting are the sections dealing with the necessity for ventilation in relatively recent industries such as magnesium foundries. [*"Industrial Hygiene at Work in Defense Industries," by Warren A. Cook. Paper presented before the Sixth Annual Meeting, Industrial Hygiene Foundation of America, Inc., 4400 5th Avenue, Pittsburgh, Pa.*]

ZINC SUBSTITUTES. The substitution of paint for galvanizing is a direct contribution to the country's defense, according to OPM, which has issued a mimeographed report entitled "Substitution of Paint Coatings for Metallic Zinc Coatings." A section of this report deals with the painting of interior sheet steel formerly zinc-coated, such as air ducts. [*"Substitution of Paint Coatings for Metallic Zinc Coatings," by E. F. Hickson. Six mimeographed sheets; the Department of Commerce, National Bureau of Standards. Limited number of copies available at the Specifications Branch, Bureau of Industrial Conservation, Office of Production Management, Washington.*]

COKE. A mimeographed report of the Bureau of Mines on byproduct and beehive coke during 1940. The report is largely statistical in character. [*"Distribution of Byproduct and Beehive Coke in 1940." 27 mimeographed sheets No. MMS 942, published by the United States Department of the Interior, Bureau of Mines, Washington, D. C.*]

CARBONIZATION. A bibliography covering the period 1900-1940 of articles relating to electrical carbonization of coal. [*"Electrical Carbonization of Coal—A Bibliography, 1900-1940, by H. Stevens, 32 Ehrman Ave., Cincinnati, Ohio. Paper cover; 8½ x 10½ in.; 24 pages. No price listed but apparently offered for sale by the author.*]

VENTILATION. A bibliography on exhaust ventilation presented by Professor Hatch at the sixth annual meeting of the Industrial Hygiene Foundation of America. Bibliography consists of articles and papers about one-third of which deals with ventilation in general and the other two-thirds deal with ventilation in specific industries. [*"An Evaluation of Present Exhaust Ventilation for the Control of Industrial Health Hazards," by Theodore Hatch and Robert H. Walpole, Jr., Department of Public Health and Preventive Medicine, University of Pennsylvania. Paper presented before the Sixth Annual Meeting of Industrial Hygiene Foundation of America, Pittsburgh, Pa.*]

EARTH-WALLS. One of the Bureau of Standards series on Building Materials and Structures and devoted to structural, heat-transfer and water-permeability properties of five earth-wall constructions. [*"Building Materials and Structures Report BMS78—Structural, Heat-Transfer, and Water-Permeability Properties of Five Earth-Wall Constructions", by Herbert L. Whittemore, Ambrose H. Stang, Elbert Hubbell, and Richard S. Dill. Published by U. S. Department of Commerce, National Bureau of Standards. Paper cover; 7¾ x 10½ in.; 55 pages. For sale by the Superintendent of Documents, Washington, D. C. Price, 20c.*]

SPACE HEATERS. The proposed commercial standard for oil burning space heaters submitted to the oil heater industry Dec. 6. A meeting on this subject is scheduled for Chicago (Palmer House) Jan. 15, 1942. [*"Proposed Commercial Standard for Flue Connected Oil Burning Space Heaters Equipped with Vaporizing Pot Type Burners." Twenty-five mimeographed sheets, TS-3170, published by U. S. Department of Commerce, National Bureau of Standards, Washington, D. C.*]

BACTERIA. A description of the application of electrostatic principle for the removal of bacteria from the air. [*"An Electrostatic Method for Collecting Bacteria from Air," by Clyde M. Berry. Published in Public Health Reports, Volume 56, Number 42, October 17, 1941. 8 pages.*]

AIR-BORNE DISEASE. A reprint from *The American Journal of Hygiene* and covering rather highly technical information on quantitative natural respiratory contagion of tuberculosis. [*"Experimental Air-Borne Disease—Quantitative Natural Respiratory Contagion of Tuberculosis," by William Firth Wells and Max B. Lurie. Reprinted from The American Journal of Hygiene, Vol. 34, No. 1, Sec. B, 21-40, July, 1941.*]

BOILER RATINGS. The third in a series which tabulates approved ratings of cast-iron boilers; dated November, 1941. [*"I-B-R Ratings For Cast Iron Boilers." Published by The Institute of Boiler and Radiator Mfrs., 60 East 42nd St., New York, N. Y. Paper cover; 5¼ x 8¼ in.; 43 pages. Price, 15 cents.*]

OPERATING ROOM AIR CONDITIONING. A discussion of temperature and humidity ranges and hazards of static electricity in hospital operating rooms. [*"Air Conditioning and Bacteria Control of Operating Rooms Present Many Problems," by L. J. Mamer. Published in Hospital Management, July, 1941 issue, pages 57-60.*]

FIGURING HEAT BALANCE—ANTHRACITE BURNING EQUIPMENT

The purpose of this sheet is to enable the user quickly to determine the operating performance of stoker or hand-fired anthracite-burning equipment insofar as the flue loss and ashpit loss are concerned. These data supplement those on Reference Data 37-38 which apply to any coal but in a somewhat more limited way. The charts presented here are by Ralph A. Krauss, combustion engineer, Anthracite Industries Laboratory.

Chart I permits rapid computation of the heat loss in dry flue gases. Since anthracite is composed of over 92% carbon, chemical variations in the remaining 8% have little effect on heat balance calculations.

Chart II gives the relation between the percentage of combustible in the ash and the actual loss in percentage of the total coal fed. Accurate determinations obviously require an analysis of the contents of the ashpit, a procedure seldom justified in domestic practice because of the expense. The ash content of the coal, also necessary for this computation, may ordinarily be obtained from the shipper, but for most purposes an average figure will give reasonably accurate results. The Bureau of Mines has recently conducted a survey of the major sources of Pennsylvania Anthracite, reporting the average ash content of No. 1 buckwheat as 11.7% and of rice 12.4%.

Under average conditions the ash will not contain over 25% combustible, and the maximum for acceptable operation (according to the National Bureau of Standards) is 40%. It therefore be-

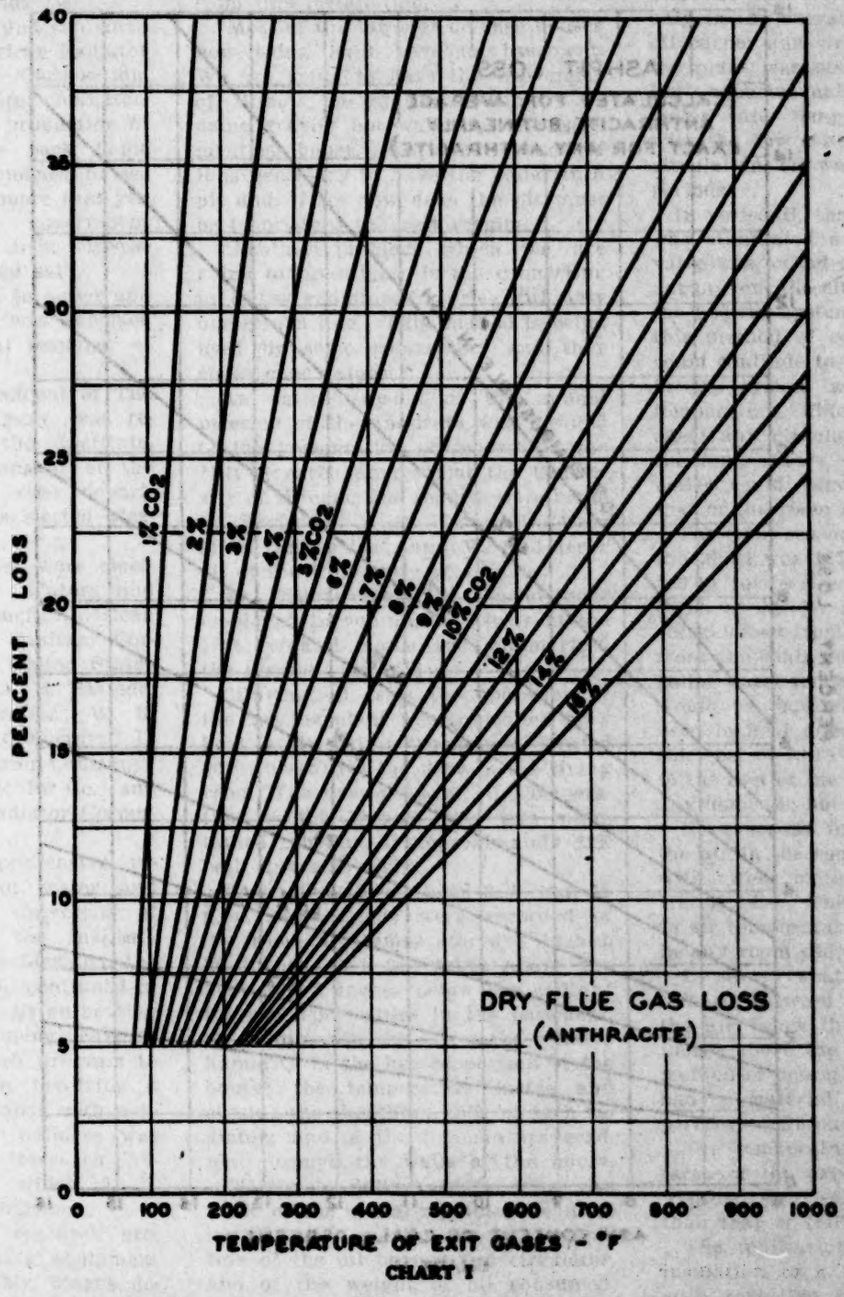


CHART I

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H. & V.'s REFERENCE DATA—213

comes obvious that the ashpit loss will average about 4.5%, with a maximum, under heavily-loaded conditions, of about 9%.

Heat in the water-vapor in the flue gases varies with the percentage of hydrogen in the coal, the temperature of the flue gas, and several minor factors. Ordinarily, however, it remains between 2 and 3%, with an average of 2.5%. This figure may be safely used except in laboratory or power-plant practice.

The usual heat balance also includes another term, *radiation and unaccounted-for*. Ordinarily, the *unaccounted-for* item is negligible because of the chemical simplicity of the fuel. When the efficiency is measured directly, however, it becomes the retreat of all errors both in measurement and calculation. *Radiation* is that heat which the boiler emits from its surfaces. Whether or not the boiler is insulated, this is useful heat and not a loss, so long as the boiler room is part of the house, and is not overheated.

The following is a typical heat balance:

Loss to heat in dry flue gases (10% CO_2, 550F stack)	20.0%
Loss to ashpit (27% carbon in ash, 12% ash in coal)	5.0
Loss to moisture in flue gases (estimated average)	2.5
Efficiency (by difference)	72.5

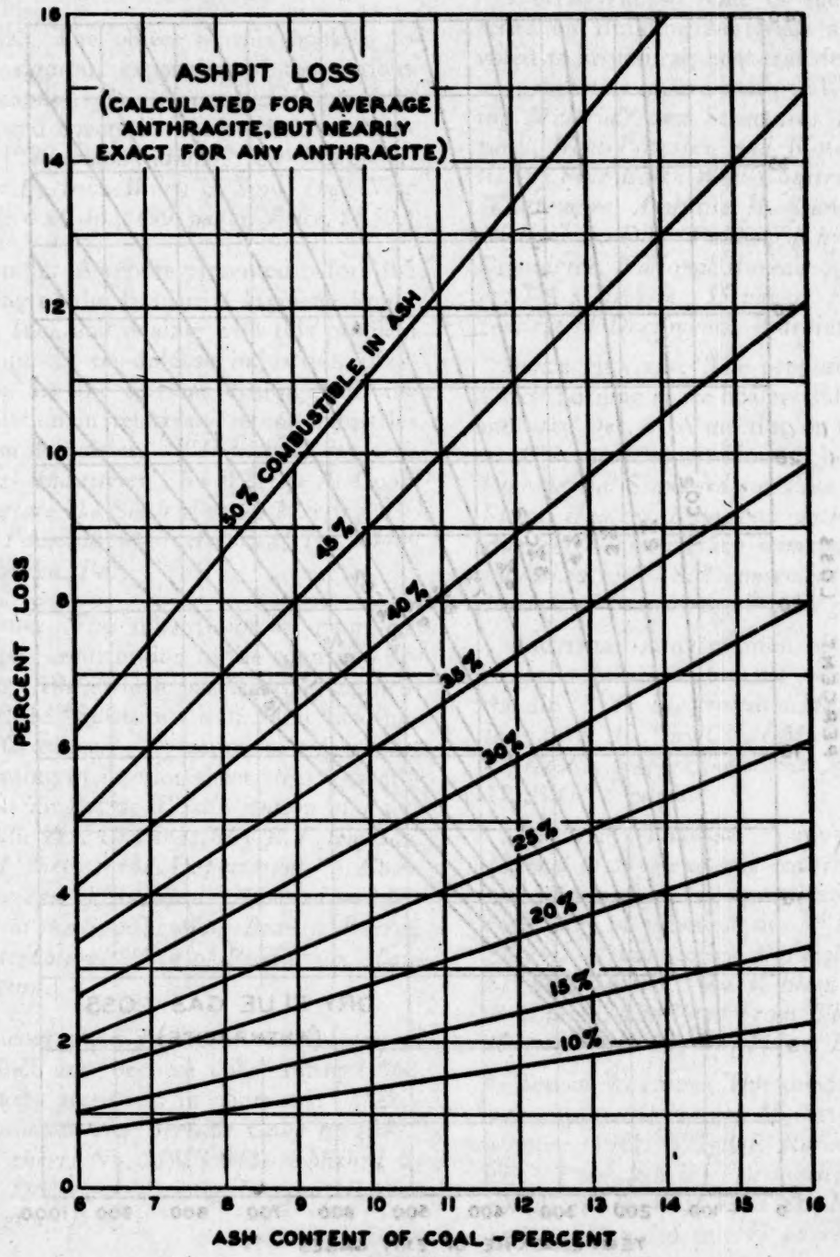

CHART II

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NEWS OF THE MONTH

Boiler and Radiator Manufacturers Report Sales Increases; Hear Reports on Research House Investigations

NEW YORK—Pledging their full cooperation in the war, members of the Institute of Boiler and Radiator Manufacturers at their annual meeting here December 9-10 discussed the conservation of critical defense metals and fuels and the conversion of foundries into armament production.

H. M. Reed, president and chairman of the board of the American Radiator and Standard Sanitary Corporation, urged boiler and radiator manufacturers to increase their production of defense materials. "Go back home and look over your foundries to see if there isn't something more that you can produce that the government needs to fight this war to a successful conclusion," Mr. Reed said.

A substantial increase in boiler and radiator sales in 1941 was reported by R. E. Ferry, general manager of the Institute.

Robert S. Waters, president of The National Radiator Company, was reelected chairman of the Institute. George E. Hoffman, manager of the plumbing and heating sales department of Crane Co., was elected vice-chairman.

The following directors were elected, in addition to Mr. Waters and Mr. Hoffman: D. D. Couch, American Radiator and Standard Sanitary Corporation; E. S. White, United States Radiator Corporation; A. E. Bastedo, Burnham Boiler Corporation; W. R. Stockwell, Weil-McLain Company; I. L. Jones, International Heater Company; Walter J. Kohler, Jr., Kohler Co.; and W. C. Murray, Utica Radiator Corporation.

Reports on a comprehensive research program in hot water and steam heating at the University of Illinois sponsored by the Institute were received. It was decided that the research work should be continued in 1942 with greater emphasis on heating for low-cost defense housing. Greater attention in the research program to methods of installation involving a saving in metals and labor with consequent lower cost to builders was recommended by the Research Advisory Committee, of which J. P. Magos, Crane Co., is chairman.

"The object of our research program is the best heating equipment for the least money," Mr. Magos declared. "During 1942 and possibly during the following years, our efforts will be concentrated on finding ways and means to cut heating costs for low-cost housing.

"One of the problems which will be studied at the University of Illinois is the effect on the environment obtained by placing radiators on inside walls. Obviously, the location of radiators on inside walls makes shorter pipe runs possible. It involves a saving in materials and labor. We want to know what disadvantages, if any, result from this installation.

"Most of the low-cost defense houses now being built have no basement. We are going to have the University of Illinois survey the possibility of using gravity hot water for the basementless house. We want to know if it is necessary to have the boiler in a pit and, if so, how deep the pit must be to produce the best results.

"Another problem which we are going to investigate is the connecting up of two radiators in series with only one return line. This method is being used by some contractors and they claim good results."

An entire session of the annual meeting of the Institute was devoted to the presentation of reports on the IBR research program at the University of Illinois. The reports were made by Professor A. P. Kratz, Professor M. K. Fahnestock, and W. S. Harris, all of the University of Illinois.

Mr. Harris explained the methods employed in running the tests at the IBR research home and summarized the results. He said:

"During all tests the operation of the heating plant was controlled by a heat anticipating thermostat located 30 inches above the floor in the living room. The average room air temperature at the 30-inch level was maintained constant at approximately 72F both day and night.

"At 7 and 11 a.m. and 3, 7, and 11 p.m., observations were recorded of the room air temperatures 3 inches, 30 inches, and 60 inches above the floor and 3 inches below the ceiling; the air temperature in the basement, the garage and the attic; the relative humidity in the heated portion of the house; the temperature inside and outside the sheathing back of each radiator; and of the temperature gradient through the walls of the house.

"Complete daily records were also made of the operating time, the number of cycles and the power consumption of the oil burner and circulator, and of the weight of oil consumed. Continuous records were made of the stack temperature, the CO_2, the temperature of the water at the boiler outlet and return, the outdoor air temperature, the indoor relative humidity, and the air temperature in each room 3 inches and 30 inches above the floor and 3 inches below the ceiling.

"Other daily observations included the total amount of electricity and gas used in the house, the number of occupants, general weather conditions, and moisture content of various parts of the house structure such as sheathing, studs, floor joists, plaster, and finish trim."

Mr. Harris also explained that two series of tests were run which differed only in the operating sequence of the oil burner and circulator. In series A, the plant was operated with the low limit aquastat maintaining a minimum boiler water temperature of 165F and with the flow control valve preventing circulation of water during the off-periods.

In series B, the low limit aquastat was eliminated and the flow control valve was locked open so that it could not prevent the circulation of water in the heating system at any time. With this method of control, the radiators could continue to cool all of the water in the system as long as sufficient temperature difference persisted to effect any circulation by gravity and the temperature of the water in the boiler could vary anywhere between that of the room and 200F.

The total seasonal cost of operating the plant was $77.50 for series A and $69.40 for series B. The difference, $8.10, or 11.7%, represents additional stack losses from the boiler resulting from the maintenance of a minimum boiler water temperature of 165F. This would be required if the boiler were used to heat domestic hot water, and this cost of $8.10 would be in addition to the cost of the fuel required to heat any domestic hot water used.

No overruns in the temperature of the air in the rooms were experienced with either method of operation, Mr. Harris said. The maximum variation in air temperature at the 30-inch level in any room did not exceed 1F.

In severe weather, the average difference between the temperature of the air below the ceiling and that 3 inches above the floor was 4.5F. The method of operating the heating plant had no material effect upon this temperature difference.

The temperature of the inside surfaces of the exposed walls in severe weather was only about 2.8F lower than that of the air in the rooms.

The application of one inch of rigid insulation to a radiator recess lined with reflective insulation, backed by wood sheathing, one-inch air space, and 4-inch brick veneer resulted in a reduction of approximately 45% in the heat loss as compared with that lost through the same recess without

(Concluded on page 116)

Chimneys, Attic Fans, Storage Cooling, Hot Water Heating, to be Discussed at 48th ASHVE Meeting

PHILADELPHIA — The 48th annual meeting of the ASHVE to be held at the Bellevue-Stratford Hotel here the week of Jan. 26, will include seven technical sessions.

Among the subjects selected by the meetings committee for discussion at these technical sessions are: studies of panel heating and cooling, operating results of forced hot water heating systems, friction heads of screwed and welded elbows, jet-action of air streams, comfort with summer air conditioning, chimney performance studies, radiator rating tests, sanitary ventilation, heat losses from basement walls and floors.

JANUARY 26—P.M.

Panel Heating and Cooling Performance Studies, by B. F. Raber and F. W. Hutchinson.

Radiation as a Factor in the Feeling of Warmth in Convection, Radiator and Panel Heated Rooms, by F. C. Houghten, Carl Gutberlet and E. C. Hach.

A New Method for the Investigation of Periodic Heat Flow in Building Wells, by Victor Paschkis.

JANUARY 27—A.M.

Performance of a Hot-Water Heating System in Research Home, by A. P. Kratz, M. K. Fahnestock, W. S. Harris and R. J. Martin.

A Comparative Study of the Friction-Heads in Screwed and Welded Elbows, by F. E. Giesecke and J. S. Hopper.

Some Factors Influencing the Heat Output of Household Radiators, by A. C. Davis, W. N. Sawdon and David Dropkin.

JANUARY 27—P.M.

Entrainment and Jet-Pump Action of Air Streams, by G. L. Tuve, G. B. Priester and D. K. Wright, Jr.

Development and Application of a Method for Determining Sound Attenuation in Air Conditioning Systems, by D. A. Wilbur and R. F. Simons.

The Performance of Stack Heads Equipped with Grilles, by D. W. Nelson, D. H. Lamb and G. E. Smedberg.

JANUARY 28—A.M.

The Vapor Pressure of Ice, by John A. Goff.

Reactions of Individuals Working in High Temperatures, by M. B. Ferderber.

Physiological Influence of Atmospheric Humidity, by Technical Advisory Committee on Physiological Reactions, C.-E. A. Winslow, Chairman.

Sanitary Ventilation, by W. F. Wells and Richard Green.

JANUARY 28—P.M.

Pressure Loss Caused by Elbows in 8-In. Round Ventilating Duct, by M. C. Stuart, C. F. Warner and W. C. Roberts.

Performance of Experimental Chimneys, by R. S. Dill.

Heat Loss Through Basement Walls and Floors, by F. C. Houghten, S. I. Taimuty, Carl Gutberlet and C. L. Brown.

JANUARY 28—A.M.

Comfort with Summer Air Conditioning, by Technical Advisory Committee on Sensations of Comfort, Thomas Chester, Chairman.

Effect of Attic Fan Operation on the Cooling of a Structure, by W. A. Hinton and Albert F. Poor.

Heat Gain Through Walls and Roofs as Affected by Solar Radiation, by F. C. Houghten, E. C. Hach, S. I. Taimuty and Carl Gutberlet.

JANUARY 28—P.M.

Use of Cold Accumulators in the Air Conditioning Field, by R. W. Evans and C. J. Otterholm.

Design and Performance of a Direct-Fired Unit Heater, by R. M. Rush and H. A. Pietsch.

Corrosion Tests in a Water-Recirculating Air Conditioning System, by W. Z. Friend.

The Committee on Arrangements of the Philadelphia chapter consists of: M. F. Blankin, general chairman; H. Berkley Hedges, vice-chairman; C. B. Eastman, vice-chairman; R. D. Touton, secretary; honorary committee: Homer Addams, G. W. Barr, J. D. Cassell, A. W. Luck and C. V. Haynes; committee chairmen: Hotels, Karl Rugart; Publicity, J. H. Hucker; Entertainment, W. P. Culbert; Ladies, Mrs. M. F. Blankin; Banquet, H. H. Erickson; Transportation, L. A. Childs; Inspections, E. H. Dafter; Finance, A. C. Caldwell; Sessions, R. F. Hunger; Reception and Registration, H. H. Mather.

Heat Control for New Cars

DETROIT — Automatic temperature control will be a standard part of many 1942 model car heaters. With Oldsmobile, Nash and Cadillac, automatic temperature control is featured for a second year in '42 models; with Pontiac and Buick, it is new.

The necessity for automatic temperature regulation has been brought about due to the increase in heating capacity in the newer heaters which have sufficient capacity to give comfort during zero or colder weather. Obviously, on days above zero, regulation is required. This regulation is complicated by changes in car speed, wind velocity, wind direction, outdoor temperature and heater air quantity (with impact type heaters), etc., it is said.

Shows Called Off

NEW YORK—Due to war conditions both the 7th International Heating and Ventilating Exposition, scheduled to be held at Philadelphia the week of January 26, and the Fourth All-Industry Refrigeration and Air Conditioning Exhibition, planned for Chicago the week of January 12, have been cancelled.

The refrigeration show was cancelled by the action of its board of directors, December 11, while the heating and ventilating exposition was called off as the result of votes by exhibitors queried as to their feelings by the management of the exposition.

Fuels Committee Formed

NEW YORK—A. E. Stacey, Jr., chairman of the ASHVE committee on research, announces the appointment of a new technical advisory committee on fuels, with R. A. Sherman, Columbus, Ohio, as chairman.

This committee is to deal with the utilization of fuel for comfort heating and for service hot water in residences, apartments and office buildings. This includes the characteristics of fuels, the mechanism of the combustion of fuels, the design of equipment for the combustion of fuels, the design of boilers, furnaces, and space heaters, the design of automatic controls for such equipment, and the equipment by which the waste products, ash and flue gases, are removed from the heating equipment.

Other members of the committee who are responsible for outlining and supervising this work, are: R. M. Conner and E. C. Webb, Cleveland, Ohio; R. S. Dill, R. K. Thulman, and A. C. Fieldner, Washington, D. C.; L. N. Hunter, Johnstown, Pa.; S. Konzo, Urbana, Ill.; W. M. Myler, Jr., Columbus, Ohio; H. J. Rose, Pittsburgh, Pa.; C. E. Shaffer, Kearny, N. J.; and T. H. Smoot, Baltimore, Md.

Boiler Manufacturers Meet

(Concluded from page 115)

insulation.

Following the presentation of the paper by Mr. Harris, Professor Fahnestock reported on an economic analysis of house heating plants. Detailed cost figures in systems ranging from a hand-fired hot-water heating plant costing $350 to an oil-fired plant costing $520 were presented. These field survey jobs by Professor Fahnestock were made for the Technical Committee in its efforts to analyze heating plant costs with the object of studying ways and means for cost reduction.

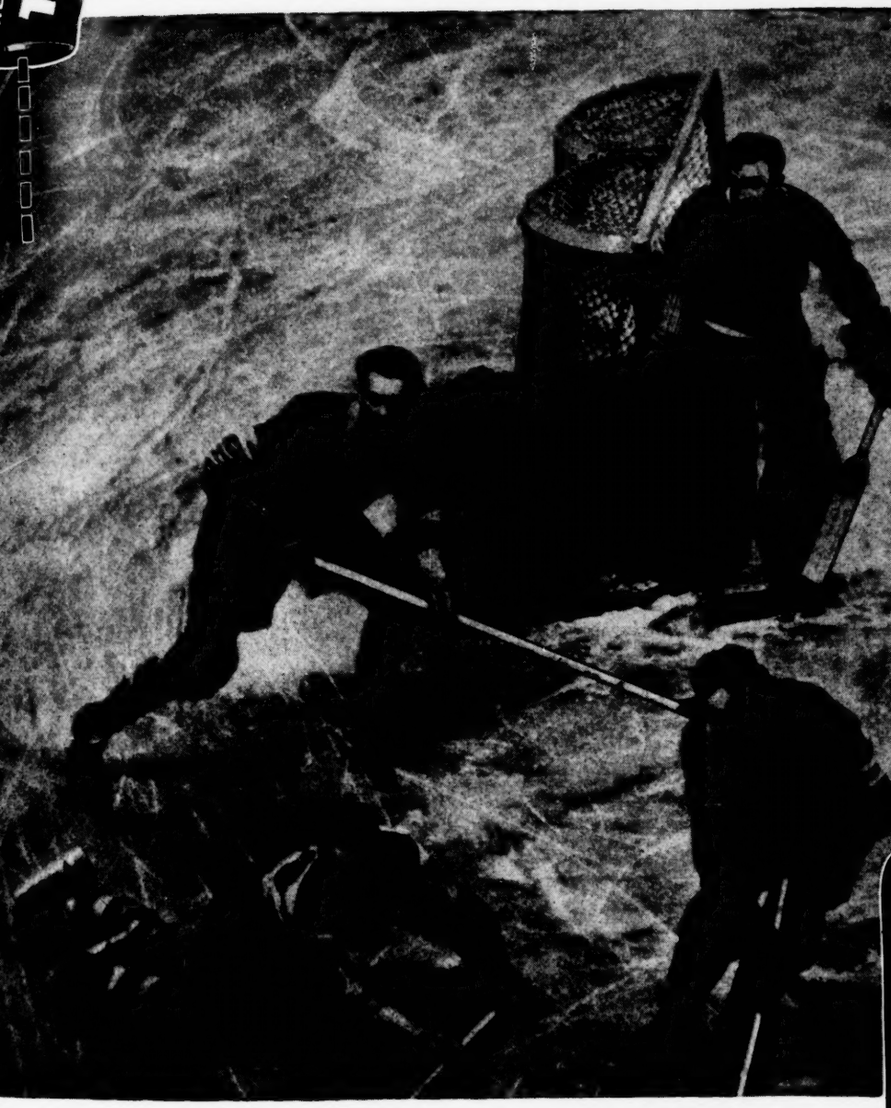
Professor Kratz outlined emergency tests to meet new problems in housing and also explained long-range objectives of the IBR research program.

Among the immediate studies which the University will make at the IBR research home next year are the savings in fuel effected by setting the thermostat back 9F at night and the fuel savings resulting from storm windows.

Martin Weil, vice-president of the Weil-McLain Company, urged the standardization of instructions to the public on the care and operation of boilers. It was decided that the technical committee should review all literature on this subject issued by members of the Institute and to evolve a card or booklet incorporating the recommendations of the committee.

DANGER LIES AT THE TURNS

---- LOOK OUT when force hits the turns in PIPING, too!



Welding with TUBE-TURN Fittings Removes "Danger at the Turns" in Piping!

Abrupt turns and surging speed—the very things that cause most accidents on hockey—also account for major piping troubles.

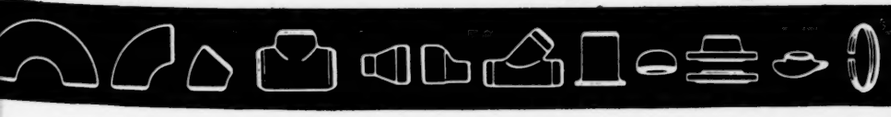
Wherever there's *a change in flow direction*, look out for extra wear and strain. Be sure of trouble-free operation with Tube-Turn Welding Fittings. They are designed and manufactured *expressly* to protect piping systems at these vulnerable points.

Here are all types, sizes and weights of Tube-Turn welding fittings—elbows, returns, tees, reducers, laterals, nipples, and flanges. For *every* welding fitting need, specify Tube-Turn fittings *by name!*

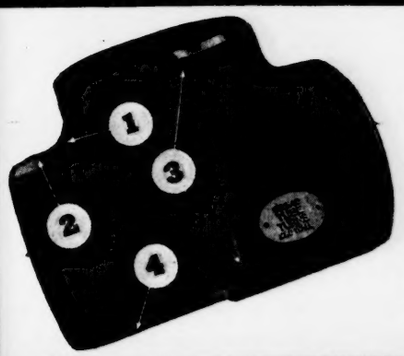
Write for Tube-Turn engineering data book and catalog.

TUBE-TURNS, Inc., Louisville, Ky. *Branch offices:* New York, Philadelphia, Chicago, Pittsburgh, Cleveland, Tulsa, Los Angeles. *Distributors everywhere.*

TUBE-TURN *Welding Fittings*
TRADE-MARK



PROTECTION AT THE TURNS IN TUBE-TURN WELDING TEES



(1) *Extra thickness at crotch,* (2) *reinforcement along top of run,* (3) *reinforcement on sides,* and (4) *increased thickness at bottom* give extra strength to Tube-Turn tees at the points where stress and strain are greatest.

CROSS-SECTION OF TUBE-TURN ELBOW SHOWS SUPERIOR DESIGN

Here are vital engineering advantages that tell quickly why you get more with Tube-Turn welding elbows—*the elbow that made ALL Tube-Turn fittings famous.*

Restrictive Stoker Specifications Condemned by Army

WASHINGTON—The practice of having restrictive specifications written into invitations to bid on stokers needed for Army construction projects has been characterized as "Perhaps good salesmanship but bordering upon sharp practice," by the Corps of Engineers which will in the future consider the presence of restrictive specifications as cause for rejection of bids.

Restrictive specifications find their way into bid proposals after the various Army posts have been instructed to buy stokers in accordance with Army Specifications, according to Captain L. C. McCabe, Repairs and Utilities Branch, Fuel and Service Section, Corps of Engineers. After the general specifications have been shown to prospective bidders, salesmen have, in some instances, been able to induce local purchasing officers to write into the specifications a requirement or two that would limit deliveries to one or two bidders, Captain McCabe stated.

Submitted to Washington for approval, the restrictive clauses have been noted and there have been cases in which delays of several weeks have followed, he continued. It is to avoid such delays that the Engineer Corps is issuing instructions that the General Specifications for Stokers and Stoker Installations must be followed, or the bid will be discarded and awarded to manufacturers complying.

"In these times the Army wants satisfactory stokers quickly, but it cannot condone the tendency to limit bidders by writing in restrictive clauses in bid proposals. The General Specifications for Stokers and Stoker Installations are open to examination by the industry, and if the industry as a whole has constructive suggestions to make, they will be welcomed by the Corps of Engineers," he said.

"Under the new program it will be necessary to distribute business as widely as practical in order to assure satisfactory delivery schedules, but wherever possible we plan to follow the policy of grouping stoker installations," said Captain McCabe. "Thus, instead of having half a dozen different types of stokers in a single camp or post, we prefer to standardize the stokers in each post, splitting the business by areas rather than on a given contract.

"Under this plan it would be necessary to maintain only a single set of replacement parts in a given camp or post, and repair men familiar with a given type of stoker should be better equipped to assure good service than would be the case if they were required to service varying types."

Hattis Speaks on Hot Water Heating Before Chicago Group; Emphasizes Desirability of Proper Venting

CHICAGO—Robert E. Hattis, consulting engineer, spoke on hot water heating at the December meeting of the Illinois Chapter of the ASHVE. Sixty members and guests attended.

The speaker pointed out that whereas systems are designed for —10F weather which prevails less than 5% of the time, the problem is to provide comfort with this top-heavy system for the balance of the time. He pointed out that the prime requisite for comfort in all kinds of weather in all parts of the heated spaces is continuous delivery of heat in varying quantities as needed and where needed. Water which may have any temperature from 32F to 212F at atmospheric pressure may be used at an intermediate temperature to provide an intermediate heat output of the radiator system and do so continuously. Through the use of pumps for forced circulation the hot water system is able to operate with smaller pipes and provide immediate circulation of heat. Furthermore, through the use of a pressure system higher water temperatures may be used with radiators 10% larger than steam sized radiators. With forced circulation, radiators may be located below the heating mains, making possible comfortable heat in basement spaces without underground returns and expensive tunnels which would be required with other systems to permit basement heating at the floor. Through the omission of underground returns the expense of replacing corroded piping is eliminated.

Since the largest dollar volume of heating equipment is in low cost housing, the forced circulation hot water system offers an opportunity for the heating industry to move boiler and radiator equipment. The forced circulation system facilitates the use of basement spaces, and together with recessed radiators and package decorative boiler units minimizes the waste spaces in housing.

In addition to low cost housing the use of forced circulation hot water is desirable in large projects in housing and in industrial, commercial and institutional uses.

In connection with the use of hot water for ventilating work, the speaker called attention to the use of parallel flow, the hottest water meeting the incoming air and the coldest water somewhat warmer than the leaving air. He also called attention to the absolute uniformity of air leaving the coils when two or more pass coils were used. Also, since water temperature may be modulated through a great range of temperatures, constant temperatures of leaving air can be maintained. The elimination of varying air supply temperatures minimizes the draft problem.

The speaker made a few suggestions in connection with hot water systems emphasizing the desirability for proper venting and the necessity for adequate expansion tanks, and suggesting the location of same in the attic where, on pressure systems, the tank has three times the water expansion capacity and minimizes the pick-up of air by the water by having the water in contact with the air at the lowest pressure point. With expansion tanks located in the basement there is a tendency for air to be released as the water rises to the upper portion of the system. The expansion tank at the top eliminates this. The speaker suggested proper shut-off valves for minimizing drainage of system when repairs are required, and recommended the insulation of both flow and return piping mains.

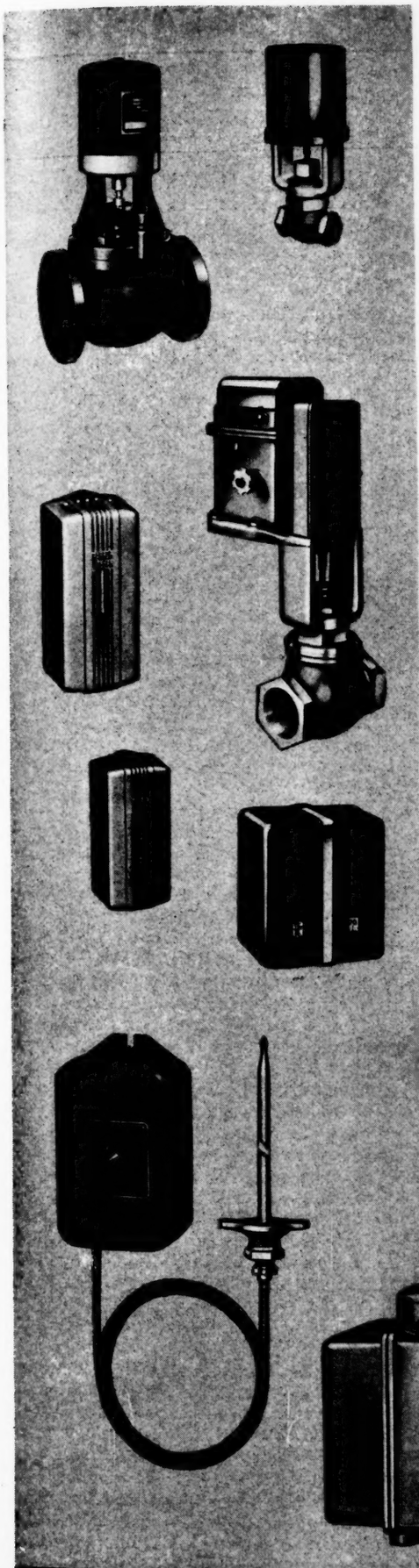
Engineers Handle Army Building Under Merger Arrangement

WASHINGTON — Legislation placing under the Corps of Engineers the $3,500,000,000 Army defense construction program with more than 600,000 employes on projects in every state, Hawaii, Alaska, and Panama, as well as island bases in the Western Hemisphere, was signed December 2 by President Roosevelt. The construction program of the War Department previously had been divided between the construction division of the Quartermaster Corps and the Engineers Corps. The merger was said to have been taken for reasons of economy and efficiency.

Major General Eugene Reybold, Chief of Engineers, commented on the consolidation move as follows:

"For the present all personnel of the Corps of Engineers and the Construction Division, Office of the Quartermaster General, will continue to function exactly as they have in the past. Brigadier General T. M. Robins, who has headed the Construction Division of the Corps of Engineers since August, 1939, will direct the combined construction organizations. All engineer district and division officers will be continued and some new districts will be established as required.

"Architects, contractors and engineers should immediately benefit from this consolidation since they will be able to deal with the decentralized field organization of the Corps of Engineers. Much authority has been delegated to the 11 divisional and 51 district engineer offices located in all parts of the country.



MAXIMUM SERVICE

Electric BARBER B-C COLMAN *Controls*

MINIMUM MAINTENANCE

Barber-Colman Control Motors and Motor-Operated Valves Have These Outstanding Features:

★ ADJUSTABLE SPEED. A knob on the outside of the case permits accurate speed adjustment *after installation* to suit conditions. Readjustments, whenever necessary, may be quickly and easily made.

★ HIGH OR LOW VOLTAGE. Barber-Colman control units are available for operation from high voltage (110 v. or 220 v. A.C.) or low voltage (25 v. A.C.) power supply lines as conditions require.

★ BUILT-IN AUXILIARY SWITCHES. Each motor unit can be provided with one or more cam-operated switches which can be set as required to govern the sequence of operation of several units in a control circuit.

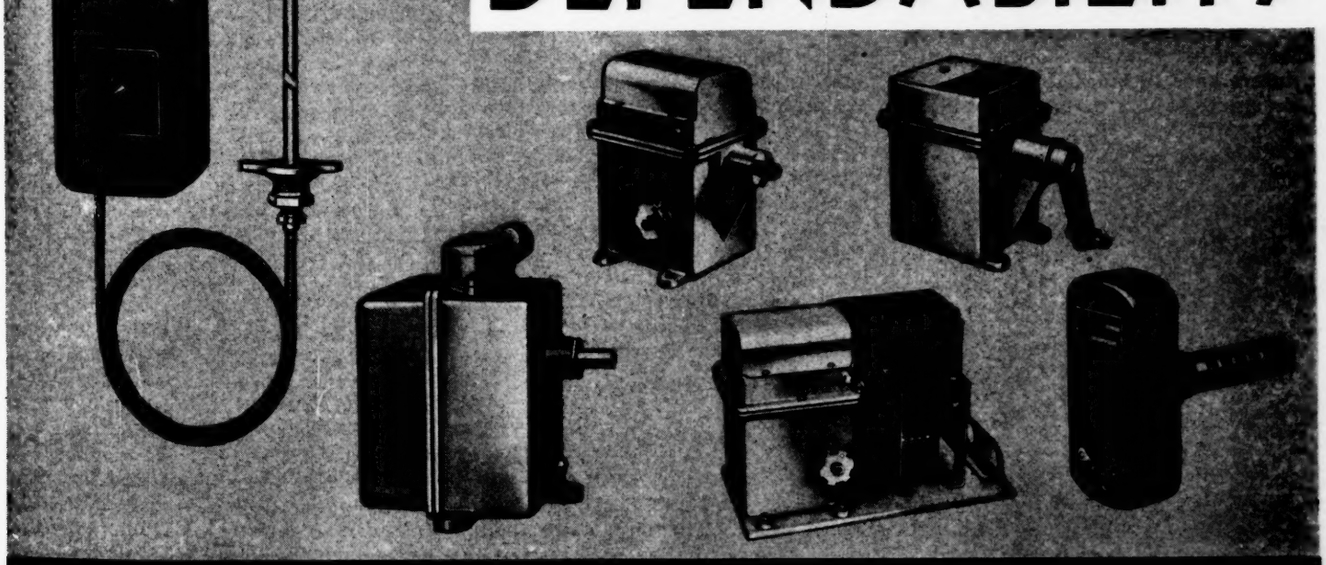
★ OIL-SUBMERGED MECHANISM. The sealed case is nearly filled with oil so that the entire mechanism runs in an oil bath, reducing wear and resultant maintenance cost to a minimum.

SPECIFY

BARBER-COLMAN

FOR

DEPENDABILITY



BARBER-COLMAN COMPANY, 1224 ROCK ST., ROCKFORD, ILL.

ASRE Elects Hainsworth

ST. LOUIS—Dr. William R. Hainsworth, of New York, vice-president of Servel, Inc., in charge of engineering, and authority in the field of refrigeration research, was elected president of the ASRE at the annual meeting here.

Dr. Hainsworth, who has been engaged in refrigeration research more than twenty years, succeeds L. L. Lewis, vice-president of the Carrier Corporation, Syracuse, N. Y., retiring president of the Society.

PBA Designs Warm Air Furnace

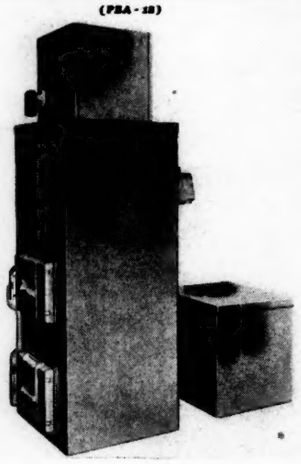
WASHINGTON—Public Buildings Administration, in connection with the construction of defense housing projects built to cost within $2700, has developed a warm air furnace occupying small space and designed to burn coal.

The reason for designing the furnace was that, according to PBA, little available equipment was on the market for heating by warm air a small low cost house without basement where coal had to be used. Consequently the 18 in. furnace was developed.

This new furnace is constructed with a steel or a cast iron combustion chamber, which has an outer casing of enameled steel with an inner steel liner arranged so that there is a positive air flow between the liner and outer casing. It produces a capacity of 60,000 B.t.u per hour, operating at a combustion rate of 4.06 pounds of coal per square foot of grate surface according to recognized laboratory tests with overall efficiency of 75.2%. The unit is provided with an electric-driven blower having a capacity of 600 c.f.m.

This design of furnace is reported as being used by practically all Government agencies constructing defense houses. At least eight manufacturers have included this design in their standard line of production.

FURNACE AND BLOWER UNIT
(PBA-18)



Furnace developed by PBA

Technical and Business Talks Scheduled by NWAHACA

PHILADELPHIA — Representatives of OPM, a speaker for the National Manufacturers' Association, and chairmen of the Association's various committees will address the 28th annual meeting of the National Warm Air Heating and Air Conditioning Association to be held here Jan. 27-28 with headquarters at the Benjamin Franklin Hotel. The condensed program follows:

JANUARY 27—A.M.

President's message, C. A. Olsen.
Our Country, by representative of NMA.
Building Construction Industry in 1942, by Thomas S. Holden.
Our Country (or Industry), by W. L. McGrath.

JANUARY 27—P.M.

Objectives and Functions of Emergency Committee, by I. L. Jones.
Simplification and Elimination of Waste, by P. S. Miller.
Defense Housing Priorities, by speaker from OPM.
Product Requirements Plan, by speaker from OPM.
Contract Distribution, by speaker from OPM.

JANUARY 28—A.M.

Our Research Activities and Cooperative Effort with Our Government, by F. G. Sedgwick.
Our Codes—Today and Tomorrow, by W. D. Redrup.
Oil Test Code, by Prof. A. P. Kratz.
Standard Code Application Manual, by Prof. S. Konzo.
Short Course, by Prof. Lorin G. Miller.

JANUARY 28—P.M.

(Joint meeting with ASHVE)

Pressure Loss Caused by Elbows in 8-in. Round Ventilating Duct, by M. C. Stuart, C. F. Warner and W. C. Roberts.
Performance of Experimental Chimneys, by R. S. Dill.
Heat Loss Through Basement Walls and Floors, by F. C. Houghten, S. I. Taimuty, Carl Gutberlet and C. L. Brown.

Shipley Gets ASRE Award

ST. LOUIS—On December 3, the American Society of Refrigerating Engineers, convening for its annual meeting here, presented its distinguished Service Award to William S. Shipley, one of its past presidents, in recognition of his leadership and outstanding effort in developing and bringing into successful use the York Plan, a cooperative plan for coordinating the community's civic and industrial activities in the interest of the National Defense Program.

Fleisher on Princeton Board

NEW YORK—Walter L. Fleisher, president of the ASHVE, has been notified by Dr. H. W. Dodds, president of Princeton University, that he was recently elected by the university board of trustees to serve for a two-year term on the advisory council of the department of mechanical engineering.

Henry G. Gombers

ORANGE, N. J.—Henry Bernard Gombers, secretary emeritus of the Heating, Piping and Air Conditioning Contractors National Association, died here Dec. 22 at the age of 81.

LETTERS TO THE EDITOR

Low Night Temperatures

EDITOR, HEATING AND VENTILATING:

I have read your article on "How Much Fuel Can Be Saved by Lowering Inside Temperatures" in the November issue of HEATING AND VENTILATING with great interest. . . . There are several points about your article which I would like to comment upon.

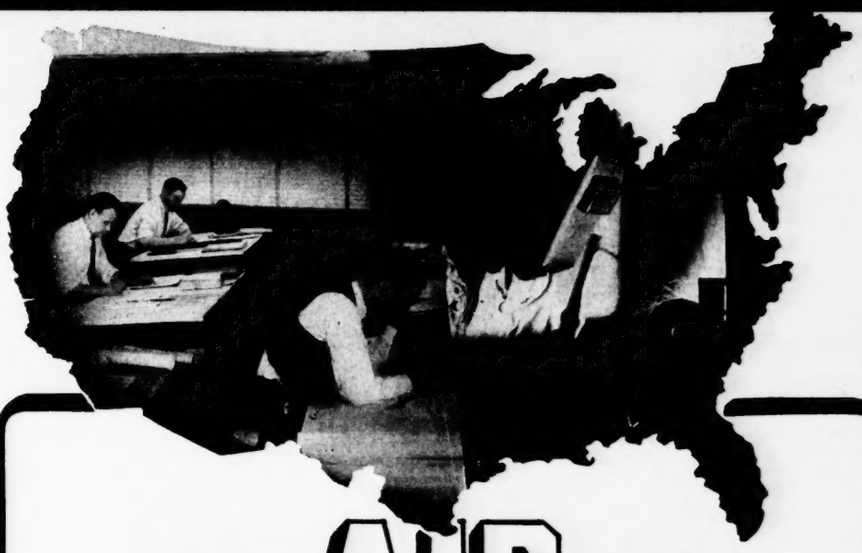
While I am in agreement with the accuracy of the formula which you use for calculating per cent fuel saving, it seems to me that there is a simpler way of arriving at the same result. If the average length of the heating season for a given locality is divided by the normal number of degree days, a figure showing the percentage of fuel saving per degree of lower inside temperature for 24 hours is arrived at directly. A percentage saving calculated in days per degree day seems to me to be a somewhat simpler way of stating the problem. Identical results can, of course, be obtained by dividing the normal degree days by the length of the heating season and dividing the degree days per day thus obtained into 1. This is, in effect, the same formula as yours.

To illustrate the above, assume a city with an average heating season of 300 days and with 6000 as its normal degree days; 300 divided by 6000 gives a fuel saving of 5%. Conversely, 6000 degree days divided by 300 days gives 20 degree days per day. This figure divided into 1 gives an answer of 5%.

As the normal degree days divided by the average heating season in the above case gives an average normal of 20 degree days per day, the average outside temperature during the heating season would be 45F. Substituting in your formula, 1 divided by (65 minus 45) gives the same figure of 5%.

You will note from the attached tabulation that the results obtained by these two methods are essentially identical except for Birmingham and Louisville. In the case of Louisville, by taking 46.0F which you give in your accompanying table as the average outside temperature during the heating season, and substituting this in your formula I get 5.26%—the identical figure which I obtain by the other method. . . .

C. E. MENGEL
Assistant to President
Weston Dodson & Co., Inc.,
Bethlehem, Pa.



USAIRCO

ENGINEERING SKILL AND MANUFACTURING INGENUITY

Reduce Air Handling Costs

AMERICAN industry, faced with its greatest and gravest responsibility, is making air conditioning a powerful ally in the nation's battle of production. Each day brings new evidence of air conditioning's essential role in plant construction, plant operation. Daily industry discovers new ways of employing the magic of controlled atmosphere to speed output, step up efficiency, improve quality, reduce health hazards, conserve time and energy.

Inspired by the pressing needs and the new opportunities created by the national emergency, USAIRCO engineers have developed many new principles of equipment design and application which conserve vital materials, save money. These savings are reflected in reasonable first costs, low maintenance costs, low operating costs.

These engineers are ready to cooperate with industry's planners and operators in finding a practical and economical solution for air handling problems. They are a resourceful group of men with a background of long and diversified experience in every field of air conditioning application — industrial, commercial, residential. USAIRCO engineering skill and USAIRCO manufacturing ingenuity, can be depended upon to quickly find the right answer at the lowest possible cost.

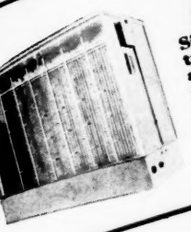
☆ ☆ ☆

Our equipment is enlisted in the Nation's "air-defense", serving battleships, air and naval bases, ordnance plants, ship yards, army cantonments, post theatres and recreational centers; in addition usAIRco manufacturing facilities are engaged in making special parts for the army, navy and air force.

Blowers

Centrifugal blowers with either forward or backward curved wheels, in types and capacities for every ventilating, circulating, exhausting, cooling or conditioning application.

Air Washers

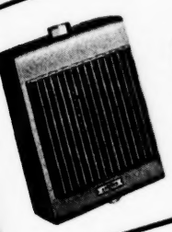


Single, double and triple stage in capacities for every job of air cleaning, cooling, humidifying, dehumidifying.

Coils

For high or low pressure steam heating; for hot water; cooling, drying, tempering; in every capacity for every coil purpose.

Unit Heaters



Suspended type steam heating units equipped with Deflecto Grilles for distributing heat in any direction upward, downward or sidewise.

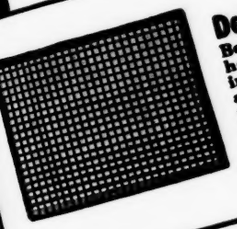
Blower Heaters

Wall, floor and ceiling models for steam or hot water; equipped with Deflecto Grilles for full directional control of heat distribution.

Unit Coolers

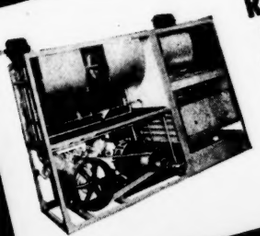
Suspended types for cold water or direct expansion; also built for combination cooling and heating applications.

Deflecto Grilles



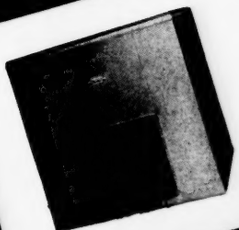
Both vertical and horizontal blades individually adjustable, giving complete directional control of air distribution at outlet.

Refrigerated Kooler-aire



"Package" self-contained units for single or multiple installations in 5 to 25-ton capacities for cooling, dehumidifying application.

Evaporative Kooler-aire



Self contained evaporative units employing patented Gyra Spray washing and evaporating systems for low cost cooling or humidifying application.

Sanidaire Humidifiers

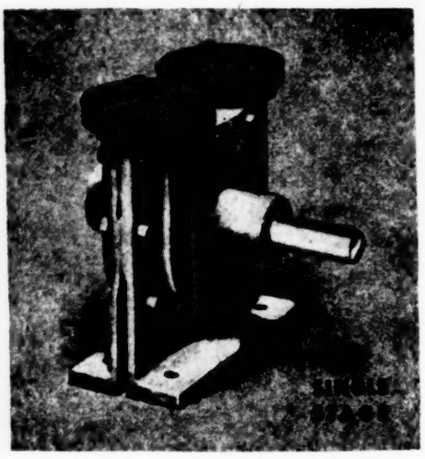
Portable, plug-in units for winter humidification in home, office and small space application.

UNITED STATES AIR CONDITIONING CORPORATION

Manufacturers of HEATING, COOLING, VENTILATING AND AIR CONDITIONING EQUIPMENT

NORTHWESTERN TERMINAL · MINNEAPOLIS, MINNESOTA

NEW EQUIPMENT



For pumping gases, liquids, and semi-liquids

Squeegee Pump

NAME—Downingtown Huber squeegee type pump.
PURPOSE—For handling gases or liquids and semi-liquids including those having a high percentage of solids.
FEATURES—Consists of a flexible rubber tube which is alternately squeezed and released in a rocking, squeegee manner so that the liquid or gas is breathed into and out of the tube. Liquid or gas being pumped is totally enclosed within tube and can not come in contact with any metal part. Pump is said to be noiseless in operation with a high efficiency and may be safely used for accurate proportioning. Requires no priming.
SIZES AND CAPACITIES—Available in six standard single stage sizes with capacities from ½ to 50 gpm and in six double stage sizes with capacities up to 100 gpm. Available in belt driven or direct connected types.
MADE BY—*Downingtown Manufacturing Co., Huber Pump Division, Downingtown, Pa.*

McDonnell Hot Water Safety Relief Valve

NAME—McDonnell No. 29 and No. 129 snap action safety relief valves.
PURPOSE—For relieving pressures on hot water heating boilers.
FEATURES—This new size valve is for hot water heating boilers with a gross Btu output of 350,000 Btu per hr. Manufacturer states that the valve is equipped with a flexible leak-proof bellows which takes the place of the usual diaphragm and the stainless steel metal to metal valve replaces the usual composition disc. The snap action mechanism of this valve is said to cause the valve to open at full orifice capacity when the relief pressure of 29 lbs is reached.
MADE BY — *McDonnell & Miller, Wrigley Building, Chicago, Ill.*

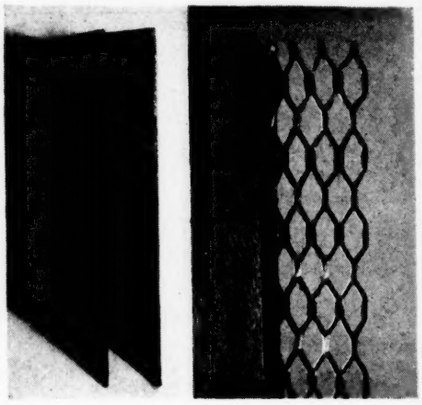
Perfex Limit Control

NAME—Perfex strap-on limit control.
PURPOSE — Limit or operating control for hot water heating systems.
FEATURES — Easy to mount, as trough-shaped base permits a snug fit in direct contact with hot water pipes. Mounting requires only fastening of metal strap to hold control to horizontal or vertical pipes, as satisfactory operation is obtained in either position. Mounting base and thermal element are same part to simplify design and to assure immediate response to changes in boiler water temperature. Temperature cut-out setting made without removing cover.
SIZES AND CAPACITIES—Available for low or line voltage circuits in direct or reverse action models.
MADE BY — *Perfex Corporation, 500 West Oklahoma Ave., Milwaukee, Wis.*

Perfex hot water control

Condensate Return System

NAME — Cochrane-Becker condensate return system.
PURPOSE — For high pressure applications.
FEATURES—The eductor principle of operation is said to insure thorough condensate and air removal from process apparatus. After expulsion of air from the closed circuit condensate is returned to boiler at temperatures close to that of process pressure without flash loss and with fuel savings.
METHOD OF OPERATION—Centrifugal pump draws water from the thermo-fin priming loop and discharges it as a high velocity jet through jet pump nozzle. This jet, striking returned hot condensate, induces condensate flow through mixing tube into thermo-fin priming loop. Additional volume of returned condensate introduced into constantly filled loop results in discharge of an equal volume through air separator to boiler.
MADE BY — *Cochrane Corporation, 17th & Allegheny Ave., Philadelphia, Pa.*



For constructing air conditioning ducts

Asphalt Mastic Board

NAME—Asphalt mastic board.
PURPOSE—Designed for duct work in industrial air blower, air conditioning and warm air systems.
FEATURES—Composed of high melting point asphalt in combination with fine mineral aggregate, sealed between dry non-bleeding liners to provide waterproof, rigid non-warping board. Said to be both acid- and alkali-resistant, and may be formed into various shapes. It is black in color, and will readily take surfacing finish. Company also offers reinforced sheet made with center core of expanded metal laminated between sheets of asphalt mastic board. This product combines properties of regular mastic board, adding the tensile strength of metal core.
SIZES AND CAPACITIES—Available in thicknesses from 1/16- to ⅛-in., widths up to 48 in., and in any length desired.
MADE BY — *Keystone Asphalt Products Company, 43 East Ohio Street, Chicago, Ill.*

T811 Chronotherm

NAME—T811 Chronotherm.
PURPOSE—Clock thermostat.
FEATURES—Provides fully automatic lowered night temperature regardless of whether Series 10, 20 or 80 control circuits are employed. Clock is self-starting motor-driven Telechron. Silver thermostat contacts actuated by a tempered bi-metal element; adjustable differential; finger-tip adjustment and setting; lock-on cover when desired; convenient wall mounting plate.
SIZES AND CAPACITIES—Standard range is 54 to 84F. Specially adapted to two-wire low voltage circuits. Said to have broad application on two-wire damper motors and solenoid gas valves.
MADE BY — *Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.*

Defense Demands

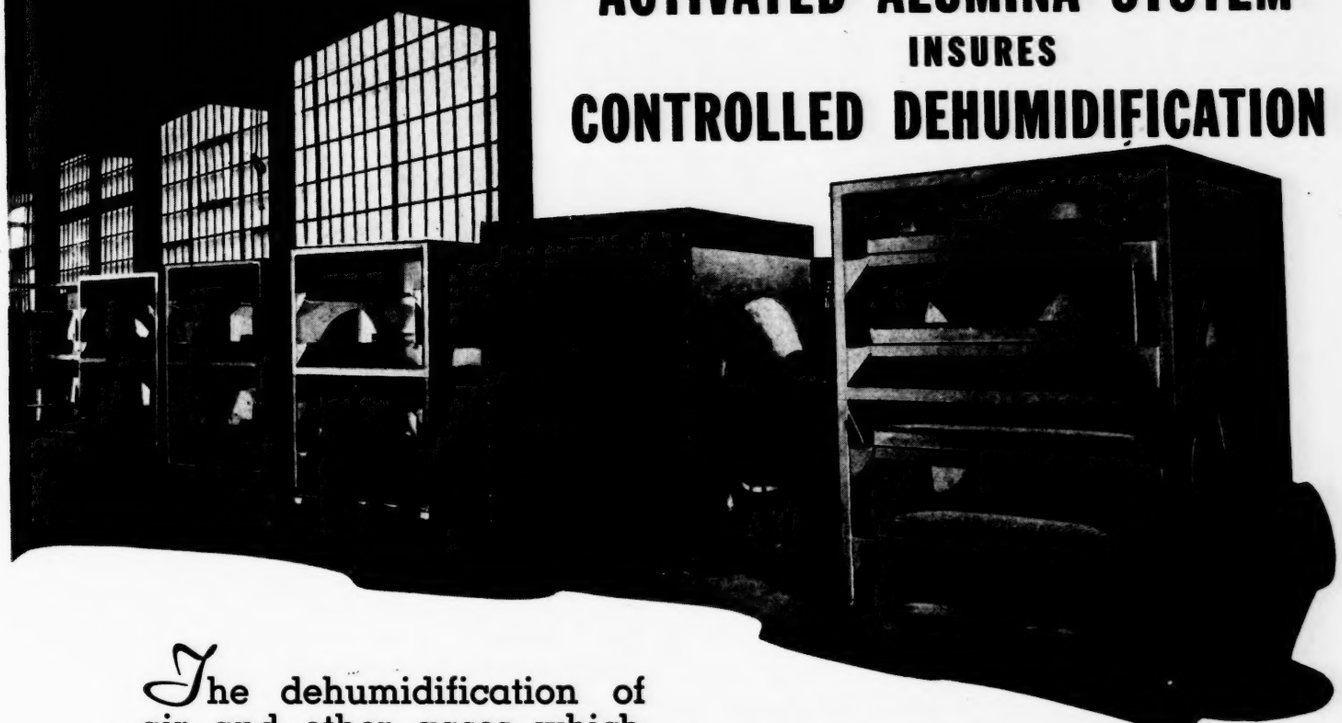
DEHUMIDIFICATION

LECTRODRYER

"ACTIVATED ALUMINA SYSTEM"

INSURES

CONTROLLED DEHUMIDIFICATION



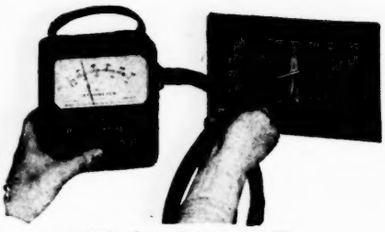
The dehumidification of air and other gases which has proved so valuable during times of peace is vital now that our country is at war.

The Lectrodryers pictured are now dehumidifying air in an exceedingly important defense project. Other Lectrodryers are being built for essential metal producing industries, for use in synthetic rubber plants, for dehumidifying oxygen, nitrogen, hydrogen and numerous other gases.

Write for details of how Lectrodryers can aid you in your defense job.

PITTSBURGH LECTRODRYER CORPORATION

P. O. BOX 1766 PITTSBURGH, PA.



Illinois velometer grille

Grille Jet for Velometer

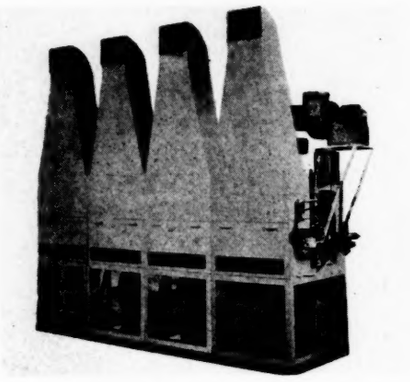
NAME—Intake or exhaust grille jet.
PURPOSE—For use with the Velometer made by the company.
FEATURES—Jet has two calibrated air intake openings, one calibrated opening being at end of main member to form a compensating tube. It extends from the grille face outward from or beyond the critical suction zone, i.e., the zone where the air pressure changes most rapidly from static to velocity. At right angles to this main member is a branch tube also calibrated to which is attached the flexible tube connecting the jet to the Velometer. The air actuating the Velometer movement is inspirated through this branch tube by the force of the suction exerted upon the main member or compensating tube.
SIZES AND CAPACITIES—Jet is offered in two sizes: low velocity of ⅝ inch OD tubing for full scale ranges of 0 to 1000 fpm and high velocity of ⅜ inch OD tubing for scale ranges of 0 to 2500 fpm and higher.
MADE BY—*Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago, Ill.*

Airstream Blower Wheel

NAME—Airstream blower wheel.
PURPOSE—For use in forced warm air heating and air conditioning.
FEATURES—Company announces addition of a 14½ in. diameter wheel to this line. Features include blade section made in continuous strip eliminating chances of loose blades; channel-shaped end rings; stamped metal hubs; curved inlets; end mounting of wheels, and spot welded assembly.
MADE BY—*Morrison Products, Inc., 16816 Waterloo Road, Cleveland, Ohio.*

Heavy Duty Unit Heater

NAME—BBC-24 series Janitrol unit heater, gas-fired.
PURPOSE—For heating of large buildings such as airplane hangars and factory buildings.
FEATURES—Heater is made up of a series of sections each section having an input rating of 250,000 Btu per hr. Each section is complete in itself with individual heat exchanger assembly, pilot, limit control, and blower. Blowers of all sections mounted on a common shaft driven by one motor. Sections are securely attached to heavy channel iron base to insure alignment of fan shaft. Heater delivers air at 100 to 125F temperature rise. Heat exchanger is of the Multi-Thermax type; burner of Amplifire type.
SIZES AND CAPACITIES—250,000 Btu per hr per section. Air velocities 1500 to 2500 fpm.
LITERATURE—Bulletin on BBC-24 series Janitrol, from the manufacturer.
MADE BY—*Surface Combustion Corporation, Toledo, Ohio.*

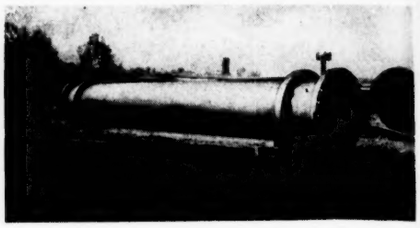


Janitrol gas-fired unit heater

Crane Water Pump Seal

NAME—John Crane bellows-type seal.
PURPOSE—A water pump seal which is said to be impervious to grease, alcohols, anti-freeze and other fluids.
FEATURES—Manufacturer states that this seal has only two parts, the bellows and the spring, and that the bellows is a synthetic rubber compound found to be superior for sealing services. The entire unit is spring driven and operates as a driving coupling. It is stated that the seal does not touch or have a sliding contact with the shaft. It is further stated that the serrated contact facings are responsible for the positive seal at both the washer and driving base point. These facings are formed in a series of concentric grooves and flat-faced ribs are designed to seal with a suction-action.
MADE BY—*Crane Packing Company, 1800 Cuyler Avenue, Chicago, Ill.*

Impervious to alcohol, anti-freeze and other liquids



Downingtown heat exchangers

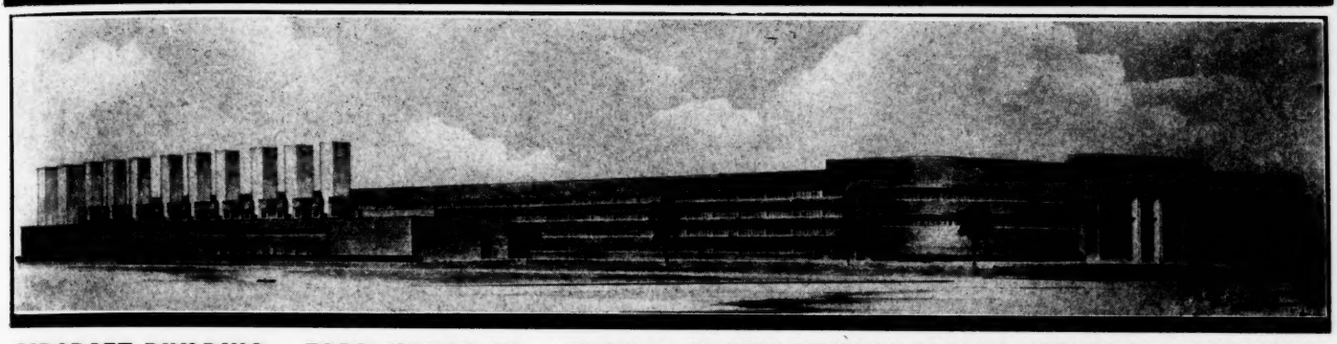
Heat Exchangers

NAME—Downingtown heat exchangers.
PURPOSE AND FEATURES—Six types. Type A is shell and tube exchanger, horizontal or vertical, straight tube. Intended for chemical applications and general liquid to liquid service; Type B is shell and tube exchanger, horizontal or vertical type, U-tube with floating removable bundle. Used for same service as A except suitable where removal of bundle is desirable; Type C is shell and tube exchanger, horizontal or vertical type. Straight tube, floating removable bundle. Used for same applications as A and B except allows for expansion, easy removal of bundle, and easy cleaning of tubes. Used for heating, cooling, condensing; Type D, shell and tube exchanger, horizontal or vertical. Straight tubes, fixed tube sheets, bonnets on each end. Used for freon and ammonia condensing, water and brine cooling for refrigeration and air conditioning, heating of fuel oil and other applications using a condensing vapor as heating medium; Type E is storage water heater of extra heavy steel or non-corrosive alloy with removable U-tube heating element; Type F is shell and coil exchanger used for storage cooling or heating where coil surface is most desirable or where larger storage volume is required.
MADE BY—*Downingtown Iron Works, Inc., Heat Transfer Division, Downingtown, Pa.*

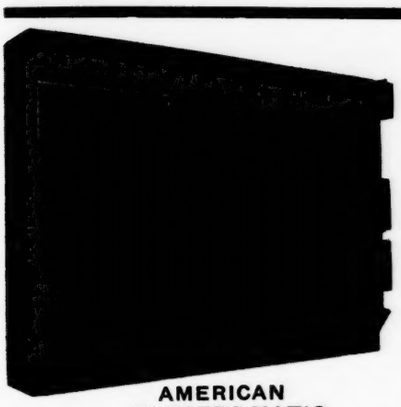
Precipitron Cleaner

NAME—Precipitron cleaner.
PURPOSE—To clean the dirt from the company's Precipitron.
FEATURES—Device is semi-automatic and performs its function with a brief service interruption to only a small section at a time. Cleaner has motor-driven carriage that sweeps slowly up and down in front of the dirty precipitator plates. Carriage has three horizontal rows of nozzles from which water, air, and oil are sprayed in turn over the plates. The operation then stops, having lasted but 30 minutes. All the operator needs to do is to start it and a half hour later return and move it to the next section.
MADE BY—*Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.*

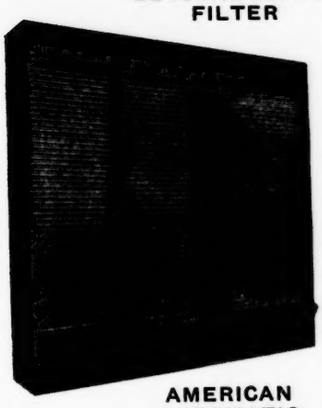
American Air Filters protect men, materials and machines in National Defense Plants



AIRCRAFT BUILDING - FORD MOTOR CO. - TYPICAL OF NEW DEFENSE PLANTS SERVED BY AAF FILTERS



AMERICAN ELECTRO-MATIC FILTER



AMERICAN AUTOMATIC FILTER

AIRMAT DRY FILTER

VISCOUS UNIT FILTER

. . . wherever production must not be slowed down by destructive DUST, SMOKE, SOOT or FUMES . . .

Wherever the countless defense materiel are being made, clean air is playing a vital role in keeping production lines moving at unprecedented speed. Men and women who operate machines must breathe freely of clean wholesome air . . . and those machines must be protected from the ravages of abrasive dust. AAF filtration and dust control equipment delivered to plants engaged directly in making war materials comprises approximately 92% of our output. Bulletins describing in detail the entire line of American Air Filter products are available on request.

•

THE ELECTRO-MATIC FILTER *combines electrical precipitation with automatic air filtration to obtain the highest efficiency in the removal of atmospheric dust and smoke. Widely used in aircraft motor manufacturing plants. Ask for Bulletin No. 250C.*

THE AMERICAN AUTOMATIC FILTER *is completely automatic in its operation, eliminating need of attention and assuring satisfactory performance at all times. Widely used in airplane assembly plants, tank arsenals, etc. Ask for Bulletin No. 241.*

AAF AIRMAT DRY FILTER *uses standard Airmat medium in continuous sheet form furnished in 225 foot rolls. Approved by National Board of Fire Underwriters. Extensively used in ordnance and powder plants. Ask for Bulletin No. 230C.*

PERMANENT WASHABLE VISCOUS UNIT FILTER *for industrial air cleaning where sturdy construction, high efficiency and large dust holding capacity are essential. Widely used for cleaning air supplied to barracks and theatres in army camps and cantonments. Ask for Bulletin No. 201D.*

When writing for Bulletins, please address 293 Central Avenue, Louisville, Kentucky.

TYPICAL COMPANIES NOW USING AMERICAN AIR FILTER EQUIPMENT

Boeing Airplane Company
Allison Division of G. M.
Curtiss Wright Corporation
Ford Motor Company
General Motors
North American Aviation
Studebaker Corporation
Edw. G. Budd Co.
Dupont Company
Springfield Arsenal
U. S. Naval Yards
Caterpillar Tractor Co.
Chrysler Motors Co.
Hudson Motors Co.
Harley-Davidson Company
Vultee Aircraft Co.
Douglas Aircraft Co.

AAF

AMERICAN AIR FILTER COMPANY, INC., LOUISVILLE, KY.

For temperatures up to 1800F.

Baldwin-Hill Insulating Cement

NAME — Baldwin - Hill insulating cement B-H No. 1.

PURPOSE — An insulating cement which is effective up to temperatures of 1800F.

FEATURES—Manufacturer states that this insulating cement contains a rust inhibitor which prevents any corrosion from taking place at the point of contact between the metallic surface and the cement. The cement is said to be a highly efficient maintenance insulation easily applied and requiring no special skill. It is said to be effective for temperatures up to 1800F and when used on equipment that operates on temperatures no higher than 1200F it is 100% reclaimable. It is further stated that the cement has a low volume shrinkage; it is sufficiently elastic to absorb expansion and contraction without peeling or cracking. It is adaptable for use on such equipment as boilers, ducts, valves, flanges, breechings, and similar equipment. Material is packed in 50 lb paper bags.

MADE BY — *Baldwin - Hill Co., 529 Klagg Ave., Trenton, N. J.*

Commercial Stoker

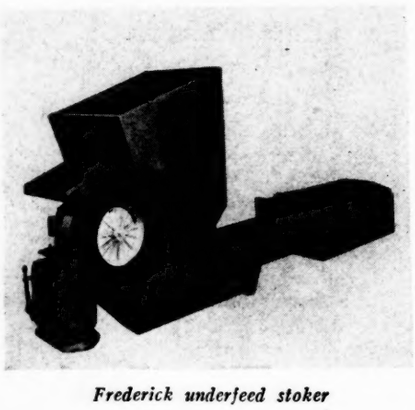
NAME—Frederick underfeed screw type stokers.

PURPOSE—For commercial and industrial applications.

FEATURES—Line incorporates both hopper and bin feed models with clinker type burners, as illustrated, or with side dumping grates. Equipped with heavy duty, three speed automotive type transmissions, oversized motors and fans. Totally enclosed windboxes and stoker fronts provided. Two doors in stoker front for windbox cleanout. Self contained burning ends made up of segmental type tuyeres which are interlocking.

SIZES AND CAPACITIES—200 to 850 lb of coal per hour.

MADE BY—*Frederick Iron and Steel Co., E. 7th St., Frederick, Md.*



Frederick underfeed stoker

Saran Tubing

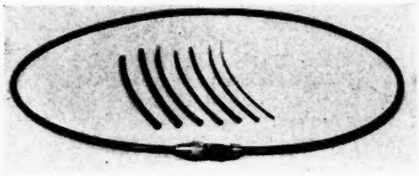
NAME — Saran, a thermoplastic tubing.

PURPOSE — For tubing use, particularly where production difficulties due to metal shortages are being experienced.

FEATURES — Said to be remarkably tough, with high resistance to moisture, brine, acids and alkalies. It can be used to replace metal tubing in all applications except where extremely high temperatures and very high pressures are encountered.

SIZES AND CAPACITIES — A wide range of sizes and thicknesses ranging from ⅛ in. to ⅜ in. O.D. Saran is also available in sheets in thicknesses from 1/32 in. to ½ in.

MADE BY—*Western Felt Works, Acadia Synthetic Products Division, 4115 Ogden Ave., Chicago, Ill.*



For replacing metal tubing

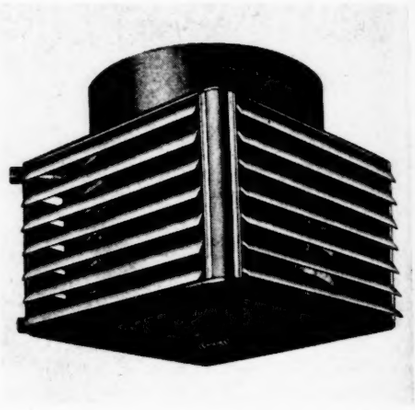
Carrier Unit Heater

NAME—Carrier Five-Way unit heater.

PURPOSE—A steam or hot water unit heater for discharging heat in five directions.

FEATURES—Manufacturer states that this unit heater is capable of discharging heat in five directions—outward four ways and downward. Unit is of the suspension type and is available with either steam or hot water coils. The direction of the air discharged may be made at any angle by adjusting the louvers in the outlets of the unit. These louvers are independently adjustable. Standard units have two outlets located on opposite sides with the other two sides consisting of a removable panel which may be replaced by outlets when desired. Louvers and panels may be interchanged even after installation. It is said that this unit heater makes it possible to heat spaces from as high as 45 ft off the floor.

MADE BY—*Carrier Corporation, South Geddes St., Syracuse, N. Y.*



Carrier Five-Way unit heater

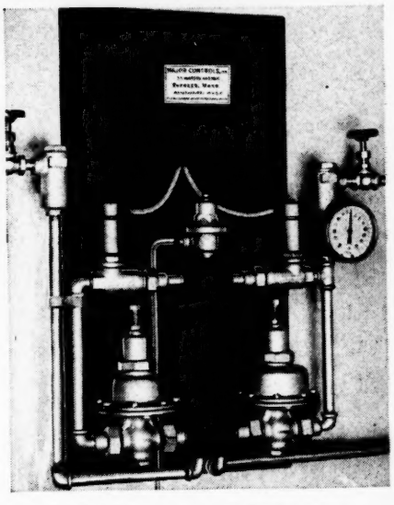
Major Controls System

NAME—Major modulating steam control system.

PURPOSE—For controlling the operation of steam heating systems in buildings, such as hospitals, apartments, and industrial buildings.

FEATURES—This model of modulating steam control operates in conjunction with a Major 3-point control thermostat which the manufacturer claims maintains inside temperature within a range of plus or minus 1F. Major model No. 40 operates in three stages, namely: pre-determined pounds of pressure, pre-determined ounces of pressure, and an all-off position. There is said to be a constant modulating action in the pressure stages. Manufacturer claims fuel savings of 15 to 30% over manual operation and that further economies are realized by elimination of excessive pressure on valves and traps. It is said that there are no revolving parts to wear.

MADE BY — *Major Controls, Inc., Everett, Mass.*



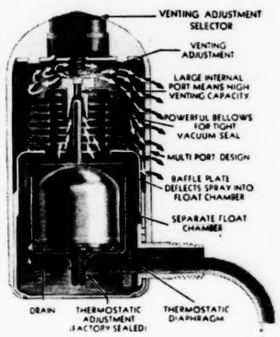
Modulating steam control system

MARSH

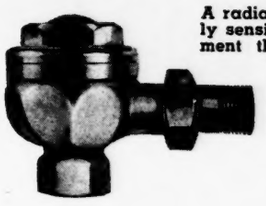
VALVES and TRAPS

MARSH Products have grown up with the industry, just as a lot of heating men have grown up with Marsh. The valves and traps shown here illustrate excellence of design and operation which only long years of specialization can achieve. Some of them offer features never before obtainable. All offer quality that is characteristically Marsh.

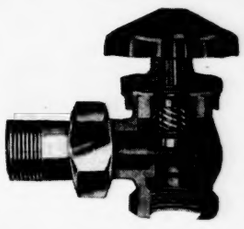
QUALITY HEATING SPECIALTIES
SINCE 1865



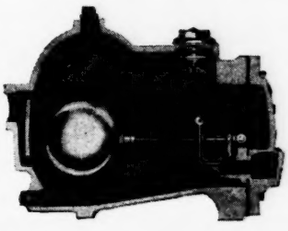
AIRLINER—the aristocrat of air and vacuum valves. Revolutionary features are the separate float chamber and ingenious baffle plate which eliminate spitting or spurting under every *possible* condition — something that has never before been fully accomplished.



A radiator trap with a highly sensitive thermostatic element that assures efficient operation. Available in both diaphragm and bellows type — all patterns.

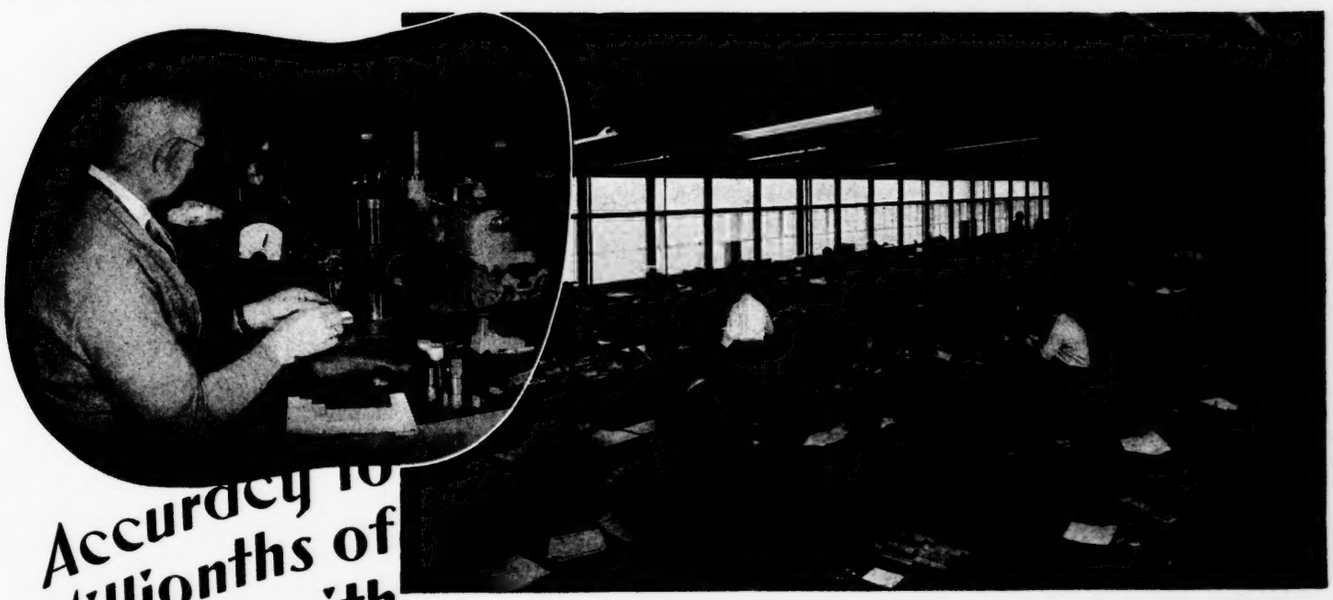


A *real* packless valve. The exclusive Marsh metal-to-metal seal makes it permanently leakproof. All patterns and sizes.



The Marsh No. 14 Heavy Duty Float and Thermostatic Trap for draining coils, headers, etc. Marsh offers a complete line of traps — float and thermostatic, inverted bucket and other types.

JAS. P. MARSH CORPORATION
2089 Southport Avenue, Chicago, Illinois



Accuracy to Millionths of an Inch with

The parts for tanks, planes and guns, produced in thousands of separate plants, can only fit together properly if made in standard sizes, to accurate gages. Pratt and Whitney secure accuracy to millionths of an inch by finishing their Hoke precision gage blocks in this air conditioned room at West Hartford, Connecticut.

Standard conditions of 68° F. and 50% relative humidity are maintained, 24 hours a day the year round, with Frick Equipment. This working space, covering 16,800 sq. ft., is believed to be more accurately controlled than any other of like size in existence. Full credit is due the Automatic Refrigerating Co., Frick Distributors at Hartford.

Put your air conditioning problems up to the experts who have nearly 60 years' experience back of their recommendations. Write FRICK CO., Waynesboro, Penna.

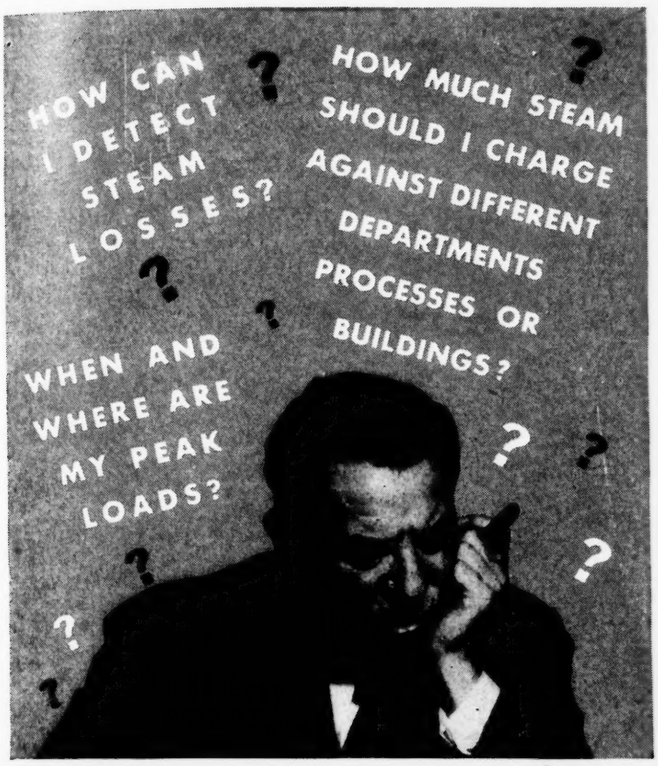
TRADE FRICK MARK

Air Conditioning

Number of Degree-Days for November, 1941

HEATING and VENTILATING continues its fourteenth year of publishing degree-day data for various large cities. Forty-four cities have been added to those previously published, making a total of 115 cities listed below.

City	Degree-Days Nov. 1940	Degree-Days Nov. 1941	Degree-Days Season 1941-42
Albany, N. Y.	807	683	1246
Alpena, Mich.	928	778	1446
Atlanta, Ga.	401	373	417
Atlantic City, N. J.	526	422	615
Baker, Ore.	993	781	1758
Baltimore, Md.	498	393	535
Binghamton, N. Y.	779	623	1101
Birmingham, Ala.	355	355	379
Bismarck, N. D.	1272	975	1856
Boise, Idaho	885	688	1345
Boston, Mass.	664	511	899
Buffalo, N. Y.	774	640	1095
Burlington, Vt.	885	771	1533
Cairo, Ill.	535	510	614
Canton, N. Y.	927	805	1550
Charles City, Iowa	1017	820	1333
Charlotte, N. C.	389	368	419
Chattanooga, Tenn.	510	516	585
Cheyenne, Wyo.	982	804	1741
Chicago, Ill.	792	653	970
Cincinnati, Ohio	637	561	755
Cleveland, Ohio	695	598	958
Columbia, Mo.	707	580	806
Columbus, Ohio	694	594	834
Concord, N. H.	797	751	1486
Concordia, Kan.	828	634	981
Davenport, Iowa	836	671	990
Dayton, Ohio	695	616	864
Denver, Colo.	813	620	1247
Des Moines, Iowa	882	692	1057
Detroit, Mich.	805	661	1050
Dodge City, Kan.	725	585	912
Dubuque, Iowa	907	701	1086
Duluth, Minn.	1175	1001	1850
Eastport, Me.	832	771	1597
Elkins, W. Va.	707	685	1040
El Paso, Tex.	422	349	421
Erie, Pa.	710	587	943
Escanaba, Mich.	968	855	1565
Evansville, Ind.	632	598	771
Fort Smith, Ark.	461	429	517
Fort Wayne, Ind.	800	708	1085
Fort Worth, Tex.	357	308	388
Grand Rapids, Mich.	817	672	1080
Green Bay, Wis.	955	795	1321
Greensboro, N. C.	499	498	617
Harrisburg, Pa.	639	557	823
Hartford, Conn.	712	596	1043
Helena, Mont.	1259	887	2020
Huron, S. D.	1114	879	1498
Indianapolis, Ind.	701	581	795
Ithaca, N. Y.	783	641	1150
Kansas City, Mo.	722	561	786
Keokuk, Iowa	771	613	876
Knoxville, Tenn.	493	506	588
La Crosse, Wis.	990	762	1262
Lander, Wyo.	1220	904	1980
Lansing, Mich.	868	717	1208
Lewiston, Me	919	794	1587
Lincoln, Neb.	888	698	1069
Little Rock, Ark.	422	416	493
Los Angeles, Calif.	91	74	149
Louisville, Ky.	555	522	658
Lynchburg, Va.	472	441	577
Madison, Wis.	941	771	1213
Marquette, Mich.	971	881	1620
Memphis, Tenn.	409	484	563
Milwaukee, Wis.	862	751	1244
Minneapolis, Minn.	1115	854	1431
Nantucket, Mass.	601	496	883
Nashville, Tenn.	502	490	566
New Haven, Conn.	658	518	862
New Orleans, La.	159	173	178
New York, N. Y.	602	464	698
Norfolk, Va.	368	285	343
Northfield, Vt.	908	825	1699
North Platte, Neb.	906	722	1257
Oklahoma City, Okla.	581	446	601
Omaha, Neb.	906	743	1133
Oswego, N. Y.	769	655	1180
Parkersburg, W. Va.	625	579	800
Peoria, Ill.	804	655	959
Philadelphia, Pa.	558	439	613
Pittsburgh, Pa.	645	568	826
Pocatello, Idaho	980	926	1802
Portland, Me.	829	752	1488
Portland, Ore.	621	470	854
Providence, R. I.	659	554	925
Pueblo, Colo.	870	688	1232
Raleigh, N. C.	385	348	405
Reading, Pa.	630	514	770
Reno, Nev.	748	621	1312
Richmond, Va.	467	413	520
Rochester, N. Y.	781	653	1175
Roseburg, Ore.	540	448	910
St. Joseph, Mo.	774	611	903
St. Louis, Mo.	628	531	705
Salt Lake City, Utah	821	692	1282
Sandusky, Ohio	749	632	935
San Francisco, Calif.	239	200	429
Sault Ste. Marie, Mich.	1034	922	1813
Scranton, Pa.	734	610	1016
Seattle, Wash.	609	474	981
Spokane, Wash.	983	744	1571
Springfield, Ill.	717	608	839
Springfield, Mo.	—	598	818
Syracuse, N. Y.	774	647	1181
Tacoma, Wash.	654	514	1090
Terre Haute, Ind.	688	575	784
Toledo, Ohio	789	666	1002
Trenton, N. J.	618	499	748
Utica, N. Y.	823	663	1278
Washington, D. C.	510	438	591
Wichita, Kan.	728	589	848
Yakima, Wash.	902	659	1263


HOW CAN I DETECT STEAM LOSSES?
HOW MUCH STEAM SHOULD I CHARGE AGAINST DIFFERENT DEPARTMENTS PROCESSES OR BUILDINGS?
WHEN AND WHERE ARE MY PEAK LOADS?

LET ADSCO ROTARY CONDENSATION METERS *Give You The Answer*

How can you arrive at accurate steam costs for separate buildings, departments or processes? . . . How can you stop steam losses unless you know where they are?

You can have this information and it won't cost you a fortune to get it. Simply install ADSCO Rotary Condensation Meters. These low cost meters are quickly installed and easily maintained. Their accuracy (factory tested within 1%) has made them the standard for leading industrial plants, colleges and district heating companies.

Available in seven sizes 250-12,000 lbs. per hour capacity.

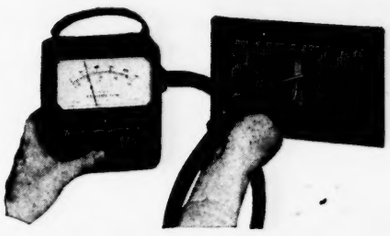
Tell us the maximum pounds of condensate per hour or the square feet of equivalent direct radiation in the building or department to be metered and we will tell you how surprisingly little it will cost to put your steam consumption on a sound accounting basis. Also ask for Bulletin 35-80V.

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA, N. Y.

Making "UP-TO-DATE" Steam Line Equipment For Over 60 Years

Now Accurate Air Velocity Measurements at Intake Grilles

A New Intake Grille Jet for Use with "Alnor" Velometers



With the introduction of the new intake grille jet for Alnor tube type Velometers, accurate, instantaneous measurement of air velocities at exhaust grilles can now be obtained.

The new intake or exhaust grille jet has two calibrated air intake openings. One of these calibrated openings is at the end of the main member. This member forms a compensating tube and extends from the grille face outward from or beyond the critical suction zone, i.e., the zone where the air pressure changes most rapidly from static to velocity.

At right angles to this main member is a branch tube also calibrated to which is attached the flexible tube connecting the jet to the Velometer. The air actuating the Velometer movement is inspirated through this branch tube by the force of the suction exerted upon the main member of compensating tube.

This intake jet is offered in two sizes (a) low velocity of 5/8" O.D. tubing for full scale ranges of 0 to 1000 F.P.M., (b) high velocity of 3/8" tubing for scale ranges 0 to 2500 F.P.M. and higher.

The new jet can be obtained with new Velometers or it can be added to Tube-Type Velometers now in use at nominal cost. It is only necessary to return the Velometer unit to the factory for altering and rescaling.

Write for full details.

See this new intake grille jet at Booth 110, Heating and Ventilating Exposition, Philadelphia, January 26th to 30th.

Illinois Testing Laboratories Inc.

143 W. Hubbard St., Chicago, Ill.

Industry Saves Money on

PLANT HEATING

★Large Industries Make Drastic Savings With *Gas-Fired* UNIT HEATERS

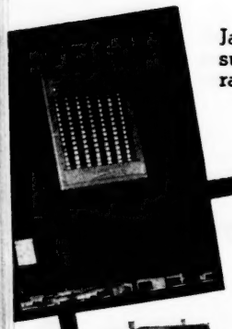
Janitrol unit heaters do more than give excellent heating results . . . do more than provide those results automatically . . . do more than conserve space. In addition to many such operating advantages, they show remarkable dollar and cents savings . . . many of America's outstanding industrial firms attest to that fact.

★ **LIBBEY·OWENS·FORD** show 54% fuel saving with 121 Janitrol unit heaters at their Charleston plant.

★ **LAKEY FOUNDRY & MACHINE COMPANY** save $15,000 on annual heating costs with their 48 Janitrol unit heaters.

★ **G & G MANUFACTURING COMPANY** use 38 Janitrols, saving yearly wages of two firemen plus 16% saving in fuel bill.

★ **HAUGHTON ELEVATOR'S** 41 Janitrol unit heaters save 53% over previous heating costs . . . and $15,000 in first investment.



Janitrol unit heaters are made in both ceiling suspended and floor mounted types. Capacities range from 60,000 to 1,250,000 Btu input.

THERE'S A TYPE AND SIZE JANITROL FOR EVERY INDUSTRIAL NEED

1. Typical propeller-fan model—**2.** Blower type with centrifugal fan—**3.** Special high velocity nozzle on blower type—**4.** Floor type heavy duty model.

JANITROL SC

GAS-FIRED UNIT HEATERS

SURFACE COMBUSTION CORPORATION · TOLEDO, OHIO

PERSONALS & PERSONNEL

Research Products Corporation, Madison, Wis., has appointed three new representatives for the distribution of Research air filters: *Wm. G. Boales & Associates,* 6429 Hamilton Avenue, Detroit, Mich., is the representative for Michigan; *W. F. Dollinger, Jr.,* 549 W. Washington Blvd., Chicago, is representative for Chicago and northern Indiana, and *H. A. Beaman,* 1032 Congress Avenue, Indianapolis, is representative for southern Indiana.

Walter Geist, vice president of Allis-Chalmers Mfg. Co., was elected a director of York Ice Machinery Corporation at a meeting of York's board of directors December 12.

Frank L. Wadsworth who has been associated with Siegmund Firestone, architect and consulting engineer of Rochester, N. Y., has left a business connection of twenty years to become associated with the Navy Department.

Cochrane Corporation, Philadelphia, announces that *Ralph J. Lundrigan* has joined the company to supervise the merchandising of the new Cochrane-Becker condensate return system.

Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa., has appointed *John H. Ashbaugh* as manager of manufacturing and engineering of its merchandising division. Mr. Ashbaugh has been acting manager of the two departments since January, 1941. He directs the manufacturing and engineering activities of the two Westinghouse merchandising division plants, in Mansfield, Ohio, and Springfield, Mass. These plants are now at work on national defense orders — for bomb fuzes, binoculars, shells and other articles for the armed forces—as well as electric home appliances and commercial refrigeration and air conditioning equipment.

Bridgeport Brass Co., Bridgeport, Conn., announces that *Herman W. Steinkraus,* vice-president and a director since 1928, has been made general manager of the company. He continues as vice-president and a director. Mr. Steinkraus, who was born in Cleveland, entered the Army as a private in the World War and rose to the rank of captain. For a number of years he was sales manager of the Osborn Manufacturing Company. In 1924 he resigned that position to start his own metals and chemicals business. Mr. Steinkraus sold his business to the Bridgeport Brass Company and became its general sales manager with headquarters in Bridgeport in 1928. A few months later he was elected vice-president in charge of sales and a director, which position he held until January, 1941.

Herske & Timmis, Inc., and the affiliated *Au-Temp-Co Corporation,* of 33 West 60th St., New York, announce that *W. W. Timmis* has resigned his connection with these two companies inasmuch as he has been called to Washington to serve with O.P.M. in connection with the handling of plumbing and heating priorities.

Kol-Master Corporation, Oregon, Ill., has elected *Robert E. Bressler* vice president and general manager. He will fill these positions in addition to his duties as chief engineer.

Bridgeport Brass Co., Bridgeport, Conn., has appointed *Harry J. Lehman* to succeed the late H. B. Whitaker as Providence district manager, with offices at 70 Clifford St.

General Electric Co., Schenectady, has appointed *Charles A. Brewer,* since 1938 the executive assistant to the head of its appliance and merchandise department at Bridgeport, Conn., as manager of distribution services succeeding H. K. Smith. The new position entails reviewing the relations and activities of all existing distributors of both the company's appliance and merchandise department and its air conditioning and commercial refrigeration department, and the consideration of distribution changes. The commercial research section, including market analyses, field surveys, consumer research, statistics and quotas, and business forecasting will also come under the supervision of Mr. Brewer.

H. A. Thrush & Co., Peru, Ind., has appointed *A. H. Belouske,* Moline, Ill., as sales representative in the Northern Illinois and Eastern Iowa territory. The company has also appointed *E. R. Pauline,* Des Moines, Iowa, as sales representative in the Central Iowa territory.

Anemostat Corporation of America, New York, has appointed *Control Engineering Company,* headed by *A. F. Erickson,* as representative in the Kansas City area. This company succeeds the Leffel Company as Anemostat representative in this area.

General Electric Co., Schenectady, N. Y., announces that *Elliott Harrington,* for the past year sales manager of its air conditioning and commercial refrigeration department at Bloomfield, N. J., has been named sales manager of the Schenectady induction motor section of the motor division. Mr. Harrington has been connected with G.E. air conditioning and automatic heating activities from their inception about 10 years ago. His early assignments on the development of an automatic oil furnace led directly to the formation of the air conditioning and commercial refrigeration department, in which he served in various engineering and sales capacities.

Manning, Maxwell & Moore, Inc., Bridgeport, Conn., has appointed *Earl C. Maund* in a sales and engineering capacity at its Chicago office. Mr. Maund's engineering services will cover the products of Consolidated safety valves, Hancock valves, American instruments and Ashcroft gauges. Mr. Maund was formerly with Sinclair Renning Company at East Chicago, Ind.

Airtemp Division, Chrysler Corp., Dayton, Ohio, has appointed *Edmund A. Orrell,* recently zone manager for White Motor Truck Co., as district manager in the Raleigh, N. C., territory. Mr. Orrell has had a long background of sales experience which includes managership of branch offices in this country and abroad, and covers merchandising of such a wide range of products as mechanical leather goods, cosmetics, securities and motor trucks.

Wagner Electric Corp., St. Louis, has promoted *H. A. Hudson,* formerly manager of the motor sales division, to manager of sales of the electrical division.

Thomas B. Hunter announces that *Robert A. Hudson* has withdrawn as junior partner and the partnership of Hunter & Hudson dissolved. Mr. Hunter will continue the practice of consulting engineer under the name of Thomas B. Hunter, 41 Sutter St., Room 710, San Francisco, Cal.

Industry needs

*CONTROLLED ATMOSPHERES

Specify and Install Kathabar for Comfort and Processing Atmospheres During 1942 and GET RESULTS!

Recently a large airplane parts manufacturer installed four Kathabar units for supplying comfort atmospheres within their general and factory offices and cafeteria. Initial costs were comparable and it is estimated that $1,200.00 per year will be saved in operation, as against other proposed methods. Unusually satisfactory results have been obtained.

One well known film and sensitized paper manufacturer has installed sixteen Kathabar units during the past four years. A large glue manufacturer has just ordered a second Kathabar unit for speeding glue drying operations. Other intricate processing operations have been simplified with the use of Kathabar Systems which eliminate the variable humidity factor from the atmosphere.

The preference for Kathabar Systems should not be overlooked by progressive air conditioning engineers and contractors. Many "tough" humidity problems can be solved by Kathabar in 1942.

Send for these Kathabar folders on Commercial Comfort, Industrial Comfort and Industrial Processing Applications. No obligation.

***Kathabar Has Solved Many A Stubborn Atmosphere Problem For:**

INDUSTRIAL PROCESSING in chemical, pharmaceutical, food, printing and paper industries; in foundries and steel plants for dry blast; in experimental and development laboratories and many other industries requiring exacting humidity control.

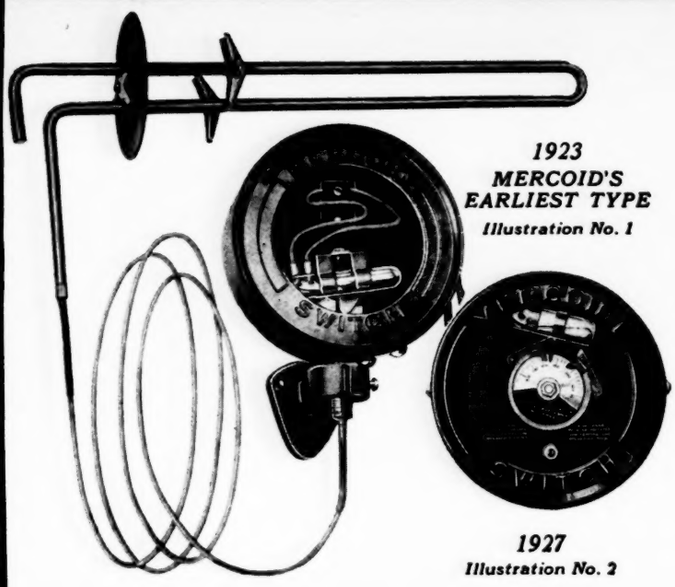
EMPLOYEE EFFICIENCY in all industrial establishments (office, factory and factory hospitals).

PATRON COMFORT in hotels, restaurants, clubs, theatres, public buildings, museums, schools, institutions, hospitals, retail stores, office buildings, etc.

KathabarSC

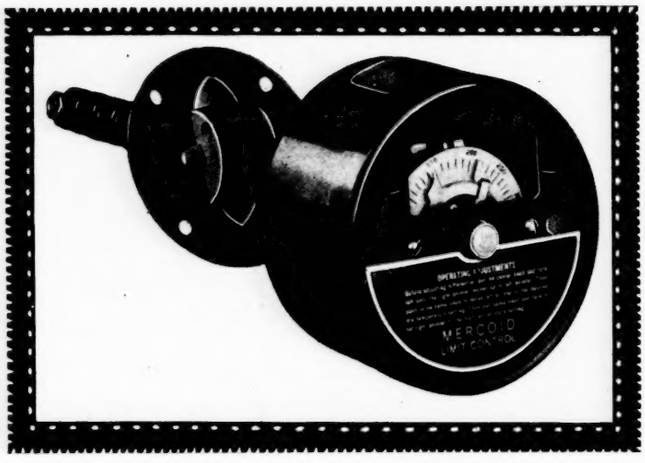
CONTROLLED ATMOSPHERES

THE EVOLUTION OF A WARM AIR FURNACE CONTROL



1923
MERCOID'S
EARLIEST TYPE
Illustration No. 1

1927
Illustration No. 2



1941—MERCOID'S LATEST TYPE
Illustration No. 3

The first Mercoid Furnace Controls were introduced in 1923. They utilized a remote stem charged with a liquid which when heated, produced pressure in a Bourdon tube type instrument to open or close the circuit (see illustration No. 1). Many of these controls were sold and many are still in use where conditions prevail that do not subject the control to excessive temperatures. In a great many early installations conditions were encountered where the temperature surrounding the bulb continued rising beyond the capacity of the instrument after the switch had opened.

The number and character of these installations were such that in 1927 with the advent of bimetals suitable for use in high temperatures The Mercoid Corporation made available to the trade, the M-51 and M-53 (see illustration No. 2) bimetal actuated controls. These instruments were designed to withstand high temperature furnace conditions in the field. They also eliminated the mechanical injury such as often occurred to the stem or connecting tube of the remote stem instrument with its resulting loss of liquid. Service on the M-51 and M-53 Controls has been remarkably low and the double adjustment features have been very popular. Hundreds of thousands of these instruments are in service.

Recently we have been aware of a demand for an external double adjustment needed in certain types of warm air heating equipment and we are now offering the Type M-41 and Type M-43 Controls (illustration No. 3) in a more compact and modern design including the proven principles and features established in the M-51 and M-53 with the addition of external double adjustment. No calculations are necessary as the pointers on the dial indicate directly the high and low settings, and are visible through the cover. A summer switch is available on the Type M-43 Fan Control.

Like all Mercoid Controls, Type M-41 and M-43 include the well known Mercoid hermetically sealed mercury switch—a feature of unquestioned superiority in all around control performance—meaning years of trouble-free service.

NEW TRADE LITERATURE

History. A fascinating and unusual brochure containing excerpts from the diary of Erastus Beethoven Badger, founder of the company which bears his name and which is this year celebrating its 100th anniversary. The diary begins with the year 1836. Most attractively illustrated with views of old Boston and with pen and ink sketches, all in colors. E. B. Badger & Sons Company, Boston, Mass.

Calculating Radiation. A simple method of figuring radiation is now available whereby the amount of calculation necessary merely requires the multiplication of room dimensions is presented in this compact folder. After obtaining these simple totals the amount of radiation necessary is quickly selected from tables in the folder. Should unusual conditions prevail for the installation under consideration, they are easily accounted for with simple adjustment factors. Radiation selection tables are provided for steam, low temperature and high temperature hot water heating systems. Working examples illustrate how the folder may be used. Guide, pocket size, folding to 3⅛ x 6 in. The National Radiator Company, 221 Central Ave.. Johnstown, Pa.

Traps. A standard size, 16-page bulletin T-1736 devoted to the company's impulse steam traps. Includes information regarding construction features, operating principles, installation and operating suggestions, prices, weights, and dimensions, together with typical installation photographs. Especially interesting portion of the booklet is devoted to instructions on figuring size of steam traps for various applications. Yarnall-Waring Company, Chestnut Hill, Philadelphia, Pa.

Pipe Covering. A standard size 4-page folder in color devoted to the company's No. 100 Pipe Covering made of rock wool and expanded metal lath. Gives complete data on water absorption, thermal conductivity and specifications. Baldwin-Hill Co., Trenton, N. J.

Instruments. Catalog No. 9004 covering the company's resistance thermometers for measuring and controlling relatively low temperatures with a high degree of accuracy. Catalog is a comprehensive presentation of the nature, design, performance and application of these thermometers. Each page is illustrated with a photograph of various types of thermometers and the catalog includes a number of schematic diagrams. Catalog is standard size, 32-page. The Brown Instrument Company, Wayne & Roberts Avenues, Philadelphia, Pa.

Evaporative Condensers. A 12-page booklet outlining the theory, operation and principal features of the company's line of evaporative condensers. Includes diagrammatic drawings and photographs, explains in detail the methods of heat disposal from both air conditioning and refrigeration and from liquids and engine jacket water. One section of the publication is devoted to horizontal, suspended-type evaporative condensers, while another deals with vertical, floor-mounted types. Large tonnage capacity evaporative condensers, ranging from 10 tons up, are included in a third section of the booklet. Carrier Corp., Syracuse, N. Y.

Stokers. Catalog No. 541. A standard size, 18-page bulletin devoted to the company's heavy duty stokers for commercial and industrial use. Includes information on new features and improvements in this line such as the automatic combustion control, reverse-flight feed screw and dividing-plate burners. The inside front cover is devoted to a list of advantages in the use of stokers while the bulletin itself gives complete information, illustrations and capacity and dimensional data on the line. KOL-MASTER CORP., OREGON, ILL.

Sheaves. Full descriptions of the company's Texsteel and Texdrive sheaves of steel and cast iron for Texrope drives from fractional to 25 hp are included in bulletin B-6047. Handy tables in the book list available sizes, various dimensions and list prices. A section is also devoted to the Texrope Super-7 V-belts. ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

Refractories. A 5¼ x 7¾ in. 72-page catalog entitled "Complete Refractories Service" and devoted to the company's refractories for a wide range of uses. Includes descriptions of different types of fireclay bricks and cements which the manufacturer makes as well as dimensional data for specialized brick for combustion chambers. GENERAL REFRACTORIES COMPANY, PHILADELPHIA, PA.

Motors. A 34-page bulletin MU-183 on single-phase, direct-current, and small polyphase motors manufactured by the company. Includes detailed descriptions of the construction of repulsion-start-induction-motors, repulsion-induction motors, capacitor-start motors, split-phase motors, direct-current motors, small polyphase motors, fan motors, and explosion-proof motors. WAGNER ELECTRIC CORPORATION, 64-62 PLYMOUTH AVE., ST. LOUIS, MO.

Vacuum Return Units. An 8-page standard size bulletin, No. 100, in color, describing, illustrating, and summarizing information on the company's vacuum return units. AMES HYDROVAC CORP., 290 SCHOLES ST., BROOKLYN, N. Y.

Electrical Machinery. Those who are not familiar with electrical phenomena or terminology can acquire a good working knowledge by reading the standard size, 48-page Catechism of Electrical Machinery, recently published in a new, revised edition. The Catechism begins by explaining electricity and magnetism as utilized in electric generators and motors, and goes on to discuss important electrical measurements. The principles of direct-current generators and motors are presented next, followed by an elementary study of alternators and alternating-current motors. Illustrations, including simplified diagrams as well as photographs, are generously used. Tables of practical application are included. FAIRBANKS, MORSE & CO., 600 S. MICHIGAN AVE., CHICAGO, ILL.

Vibro-Isolators. A standard size 8-page loose-leaf punched folder entitled "Extra Machine Hours" and devoted to the company's steel spring vibro-isolators, type S. THE KORFUND CO., INC., 48-15 THIRTY-SECOND PLACE, LONG ISLAND CITY, N. Y.

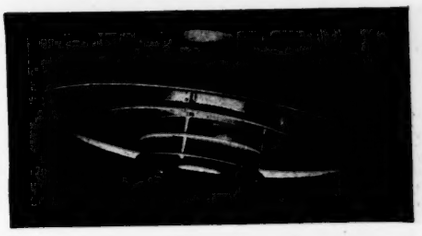
Motors. Bulletin No. 13-25 devoted to the company's rotary converters and dynamotors. Bulletin, eight pages, gives full engineering information together with tabulation of specification data. JANETTE MANUFACTURING COMPANY, 556-558 WEST MONROE ST., CHICAGO, ILL.

DOREX KNO-DRAFT AIR DIFFUSERS ARE ADJUSTABLE ... at NO EXTRA COST!

DOREX KNO-DRAFT UNITS

MODEL F

—for all average installations on low or high ceilings or exposed ducts. Equipped with air direction adjustment—standard equipment on all Kno-Draft models. Sizes from 2½" to 42" (neck diameter).



MODEL SR

—a combination supply and return unit available in sizes from 6" to 42" (neck diameter).

MODEL FL

—with built-in lighting. All Dorex Kno-Draft Diffusers are available with direct or indirect lighting equipment—the ultimate in modern decorative effects.

WRITE TODAY for Circular which gives dimensions, installation data, etc., of all Dorex Kno-Draft Units. If you wish, an experienced engineer will make recommendations on your jobs and show you how flexible Dorex Kno-Draft Air Diffusers really are.

INVESTIGATE DOREX ODOR ADSORBERS

—for scientific removal of odors and more efficient operation of air conditioning installations through reduction of load and recirculation of larger quantities of air.

DOREX DIVISION

W. B. CONNOR ENGINEERING CORP

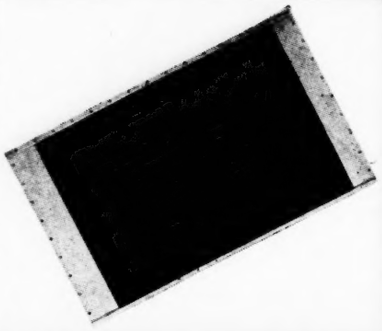
114 EAST 32 nd STREET NEW YORK N Y

McCORD

HEATING AND AIR CONDITIONING PRODUCTS

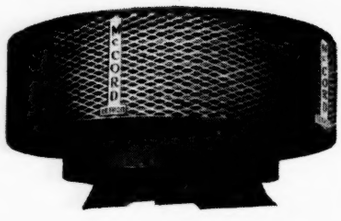
YOU CAN DEPEND ON McCORD Air Conditioning Products

BLAST HEATING COILS
AIR CONDITIONING COILS
ALL TYPES



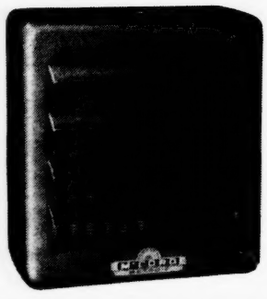
All copper tube fin construction, non-corrodible, high heat conductivity. Fins metallically bonded. Heavy copper headers. Ask for catalog.

VERTICAL TYPE UNIT HEATERS



Proven modern design, all copper spiral fin tube core. Supplied with louver, multi-cone or anemostat type outlet. Quotation on request.

HORIZONTAL TYPE UNIT HEATERS



Distinctive modern design, rugged dependable, all copper heating core, high heat transfer capacity. Core spring mounted. Specify McCord.

McCord RADIATOR & MFG. CO.
DETROIT, MICHIGAN

AIR CONDITIONING NOZZLES

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-615.

YARNALL-WARING COMPANY
104 MERMAID AVENUE
PHILADELPHIA

YARWAY

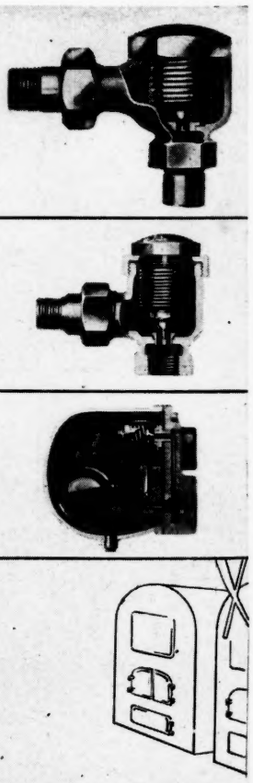
How these Sarco products

MADE ONE BOILER DO THE WORK OF 2

In Racine, Wisconsin, an industrial plant and an office building across the street were heated by two 150 h.p. boilers.

The office system was changed to hot water with a small stoker-fired boiler and Sarco Electric Temperature Controls.

Sarco Steam Traps were placed on all unit heaters, heating coils and drip points. These increased the efficiency enough to allow one boiler to handle the factory load comfortably. Catalog Nos. 250 and 38.



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SARCO SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
SARCO CANADA LTD., FEDERAL BLDG., TORONTO, ONT.

WITH THE MANUFACTURERS

Marketing, Incorporated, 828 North Broadway, Milwaukee, Wis., has taken over the distribution of the Skilbeck Humidair humidifier designed for apartments, industrial plants, hospitals, offices, and houses.

Airtemp Division, Chrysler Corporation, Dayton, Ohio, has completed remodeling operations to provide additional space for the manufacture of parts for the Bofors gun and the Martin medium bomber. The added facilities will materially increase the division's participation in the Corporation's contract for these parts. Airtemp has been active on defense contracts for more than a year, supplying heating and cooling units and specialized equipment needed by the army camps, naval bases and air fields. Much of this work has required extensive new tooling at the factory. One of the division's first Government orders called for the building of some 4,000 field ranges to Army specifications. Space heaters for Army tents, propeller balancing stands and now parts for the intricate Bofors gun and the medium bomber are included in the specialized defense work the division is doing. The company is quoting daily on additional quantities of its standard equipment, virtually every item of which meets some defense requirement.

Carrier Corp., Syracuse, N. Y., has appointed *Selvage, Smith & Lee,* 16 E. 48th St., New York, as public relations counsel.

Viking Mfg. Corp. general offices are now at Dayton, Ohio; not at Detroit as heretofore. This will expedite handling of orders for Viking Heating Appliances made to Viking specifications in Dayton by the Airtemp Division of the Chrysler Corporation.

Link-Belt Company, Eastern Stoker Division, announces the removal of its sales offices from Philadelphia to the Graybar Building, 420 Lexington Avenue, New York, N. Y. *K. C. Ellsworth* is in charge.

H&V'S PHOTOS

Pages 48-50—Jones & Laughlin Steel Corp., Pittsburgh.
Pages 55-57—Philadelphia Electric Co., Philadelphia.
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Pages 94-100—American Viscose Corp., Front Royal, Va.
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COMING EVENTS

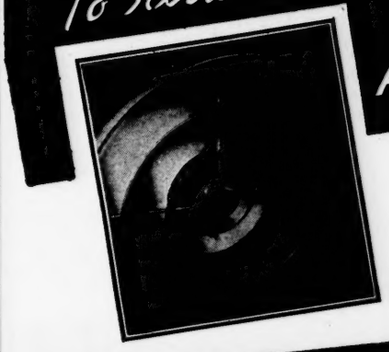
JANUARY 12-15. Fourth All-Industry Refrigeration and Air Conditioning Exhibition. This exposition, scheduled for Chicago, will not be held due to war conditions.

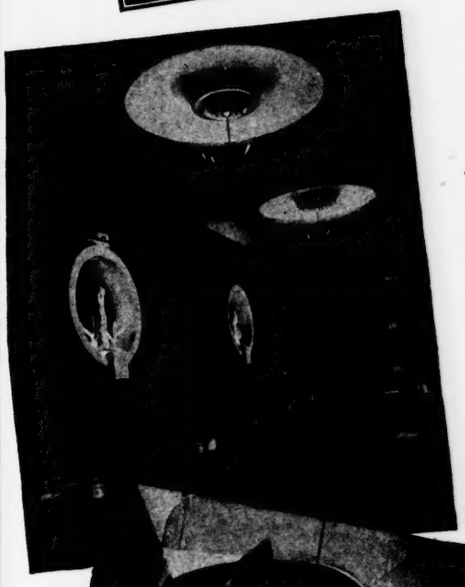
JANUARY 26-28. 28th Annual Convention of the National Warm Air Heating and Air Conditioning Association, to be held at the Benjamin Franklin Hotel, Philadelphia, Pa. Further information from the Association at 145 Public Square, Cleveland, Ohio.

JANUARY 26-30. Seventh International Heating and Ventilating Exposition to be held at Commercial Museum, Philadelphia, Pa. This exposition was cancelled January 6 in accordance with the desires of the majority of exhibitors.

JANUARY 26-30. Annual meeting of the American Society of Heating and Ventilating Engineers, Philadelphia, Pa. Headquarters, Bellevue Stratford Hotel.

Engineers Recommend
ANEMOSTATS
For Leading Installations
To Assure the Ultimate In
DRAFTLESS
AIR DIFFUSION





ENGINEERS throughout the industrial world realize the extreme importance of faultless air distribution.

This accounts for the wide usage of ANEMOSTATS, Draftless Air Diffusers, in foremost factories, offices, theatres, stores, etc.

Faultless Air Distribution means draftless distribution of the heated, cooled or ventilation air, the equalization of temperature and humidity and the prevention of stale air pockets in which the air is either too hot and too dry, or too cold and too humid.

If you have faulty air distribution, the *objectionable conditions are definitely overcome by the use of* ANEMOSTATS.

ANEMOSTATS can be installed inexpensively and quickly and are ideal for use on new or existing installations.

ANEMOSTATS produce these unparalleled results because they are the only air diffusers which operate on the following interdependent principles:

1 Air Expansion within the device, which reduces velocity instantly

2 True Aspiration, which causes room air to be drawn into the device where it is mixed with the supply air.

3 Creation of a multiplicity of air currents and counter-currents at low velocities, which causes slow but adequate secondary air motion.

ANEMOSTAT
CORPORATION OF AMERICA
10 East 39th Street • New York, N.Y.

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